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A. l. 1883.
S Y N O P S I S,

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Short Analytical View

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C H E M I S T R Y.

Translated from the *High-Dutch* of
Dr. GODFREY ROTHEN.

By *ALEXANDER MACBEAN*, A.M.

L O N D O N:

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To Dr. *SHAW*.

S I R,

I Beg Leave to inscribe the following Translation to you, as to a proper Judge in the Subject. By your excellent Performances in this Kind, you have deserved well not only of Chemistry, but of the Nation in general; as your laudable Endeavours of promoting so useful an Art among a Trading People may serve the most valuable Purposes. Suffer me also, in this publick manner, to testify my Sense of your Friendship, and to declare with how much Respect I am,

S I R,

Your most obliged,

Humble Servant,

Alexander Macbean.

~~THE~~
~~OF~~
~~THE~~

TO DR. J. H. W.

S. V. R.

I have the honor to acknowledge the receipt of your letter of the 10th inst. in relation to the publication of the "History of the State of New York," and in reply to inform you that the same has been forwarded to the proper authorities for their consideration. By your excellent testimony in this regard, you are assured that the work will not only be of extensive utility, but of the highest value to the community; as well as to the numerous of persons who are interested in the study of our country's history. I am, Sir, very respectfully,
Your obedient servant,
J. H. W.

S. V. R.

The undersigned

has the honor to

acknowledge the receipt of



P R E F A C E.

OUR Author, Dr. Godfrey Rothen, was Scholar to the celebrated Stahl, and a practising Physician afterwards at Leipfic. The early Death of so excellent a Person, he having scarce reached the One and Thirtieth Year of his Age, must have been a considerable Loss to the World, as sufficiently appears from the following Performance: A Work in such high Repute in Germany, that many of the Professors there put it into the Hands of their Pupils, and read Chemical Colleges or Lectures thereon; not to mention the Character given of it in several literary Journals, particularly the Acta Medicorum Berolinensium: But after all, we had much rather the judicious Reader should find it an useful Work in the Perusal, than barely such in our own, or others Encomiums.

It

P R E F A C E.

It is much to be regretted, that so valuable an Art as Chemistry, should be so little regarded among us, where it might turn to the best Account. In able and judicious Hands, and when duly applied, it seems productive of the greatest Good; scarce an useful Art or Science, to which its Influence does not extend. By its Means we gain a deeper Insight into Nature, and by it a Way is opened for the Discovery of new Arts and Trades, and of greatly improving those already discovered, whereby the Limits of Commerce might be considerably enlarged: And of what Consequence such an Art is to a trading People, the Reader need not be told.

In this Translation we have omitted the second Section of the second Part, entitled, The Chemical Processes, both as it is not the Work of our Author, but added by some other Hand; and as it contains nothing new or extraordinary.

There was lately published a French Translation of this Work by M. Clausier, a Physician at Paris: The Translator in his Advertisement calls it, A faithful; the Faculty of Physicians

P R E F A C E.

Physicians at Paris in their Approbation, A faithful and exact Translation: But how far this is true, may be judged from comparing it with the Original.

The following Translation is submitted to the Candor of the Reader: If in the Perusal it should not prove an elegant one, it may at least, we hope, lay claim to some Degree of Exactness and Fidelity.

C O R R I G E N D A.

P. 32. l. 11. for *acidish* r. *neutral*. P. 54. l. 9. for *this* r. *thus*. P. 69, 85, 88, 99. r. *Grund-mixtion*. P. 95. l. 18. for *Salsa* r. *Salia*. P. 100. l. 6, 7. r. *Phlogistic*.

PRELACE

Physicians at Paris in their observations, A
faithful and exact translation: But for far
this work, may be judged from comparing it
with the Original.

The following Translation is inserted in the
Course of the Reader: It is in the English
which will serve as a guide, and it may be
seen, how close to the Original it is.

CORRIGENDA

P. 11. line 1. for a. read. b.
P. 12. line 1. for a. read. b.
P. 13. line 1. for a. read. b.



A SYNOPSIS of
CHEMISTRY.

HEMISTRY is divided into Physical and Pharmaceutical; the Physical Part comprehends Alchemy, Metallurgy, the Mechanical, Oeconomical, and Curious Chemistry; and the Pharmaceutical regards the Preparation of Medicines.

In each we are to consider the Operations and Productions. The Chemical Operations change, I. The Solidity and Dryness of Bodies. II. Their Union and Cohesion. III. Their Property of abiding or bearing the Force of the Fire. IV. Their Continuity; and in Metals, their Ductility.

B

I. The

I. The Solidity and Dryness of Bodies are changed, by making them pass,

1. Into a State of Fluidity. 1. By Solution, which is done either by liquid Menstruums, in the humid way; or, by saline and sulphureous Concretes, by means of Fusion, in the dry way. 2. By Extraction, which is a partial Solution. 3. By Amalgamation, which renders Metals soft and fluid, and in some degree dissolves them by means of running Mercury. 4. By Solution *per deliquium*, which is done by the humid Vapours intermixed with our Atmosphere.

2. Into a solid and dry Consistence. 1. By Coagulation, Inspissation, Evaporation and Abstraction. 2. By Crystallisation. 3. By Precipitation.

II. The Union and Cohesion of Bodies with earthy, viscous and watry Parts are changed, 1. By Digestion and Maceration. 2. Fermentation, which produces ardent Spirits. 3. Putrefaction, which produces urinous Spirits. 4. Distillation, which is performed three several ways: *Per descensum*; *ad latus*, or by the Retort; and *per ascensum*, by the Cucurbit or Alembic. 5. Rectification, which
is

is no other than a repeated Distillation. 6. By Dephlegmation, and Concentration.

III. The Property of abiding or enduring the Fire is changed,

1. By Sublimation, whereby Subjects already volatile of themselves are raised, either in a subtile Powder, called Flowers; or in a dense and solid Body, generally called Sublimate.

2. By Volatilisation, whereby Subjects otherwise fix'd are dissipated or raised.

3. Fixation, which fixes Bodies either naturally volatile, or volatilised by Art; that is, renders them capable of enduring the Fire, either in part, as Turbith mineral; or totally, as Bezoar mineral.

IV. The Continuity of Bodies and the Ductility of Metals are changed,

1. By depriving them of it, 1. By Calcination, either by means of the Flame of an open Fire, as in Reverberation; by means of Nitre, as in Detonation; or by means of other saline and sulphureous Concretes, as in Cementation with Sulphur, Arsenic, Salt, Vitriol, &c. and in the Destruction of Metals by Zink.

2. By restoring Continuity and Ductility.
 1. By Reduction, for Metals, and some other metallic Substances. 2. By Revivification, for Mercury.

The Chemical Productions are, I. Saline.
 II. Sulphureous. III. Earthy.

I. Saline Productions are, 1. Alkali's.
 2. Acids. 3. Neutrals.

1. Alkali's are, 1. Fixt, as Salt of Tartar, Pot-ash, fixt Nitre, the black Flux, Soda of *Spain*; the Salts of Wormwood, Carduus Benedictus, Rest-harrow, Broom, Bean-Stalks, &c. 2. Volatile, as the Spirits and volatile urinous Salts of Hartshorn, Vipers, Urine, Soot, Lees of Wine, Spirit of Sal-ammoniac, both the simple, and that prepared with Quick-lime.

2. Acids. 1. Acids without Addition; as first, the vitriolic Sulphureous: To which Head belong the Spirit and Oil of Sulphur *per Campanam*, the Spirit and Oil of Vitriol, Spirit of Alum, and the *Spiritus Aperitivus Penoti*. Secondly, Nitrous Acid; of which Class are the common Spirit of Nitre, Aqua fortis, Aqua regis, and *Hoffman's* smoking Spirit. Thirdly, the Acid of Sea-Salt; as
 Spirit

Spirit of Salt, philosophical Spirit of Vitriol, and Butter of Antimony. 2. Acids dulcified by Spirit of Wine; as the sweet or dulcified Spirits of Vitriol, Nitre and Salt.

3. Neutrals; and, 1. Those properly so called, and otherwise denominated, *Enixa*, middle and digestive Salts; and they are either fixt, as vitriolated Tartar, the *Arcanum duplicatum*, *Nitrum Antimoniatum*, *Nitrum regeneratum*, Glauber's *Sal mirabile*: Or Volatile, which fly off in the Fire, either in part, as the *Terra foliata Tartari*, *Tartarus tartarizatus*, *Tartarus solubilis*; or totally, and that either in a dry Form, as Glauber's *Sal Ammoniacum secretum*; or in a liquid Form, as the *Liquor succinatus C. C.* 2. Vitriolic and mercurial Salts, as Vitriol of Iron and Copper, Crystals of Verdigrease, green Precipitate, Crystals of Silver, Sugar of Lead, various martial and solar Tinctures, Mercury-sublimate, common Precipitate, and Turbeth mineral.

II. Sulphureous Productions are, 1. Liquid and volatile. 2. Of a mean Consistence. 3. Dry and solid.

I. The Liquid and Volatile comprehend,

1. Distilled Oils, both Æthereal and Empyreumatic.

reumatic. 2. Ardent Spirits, prepared either by simple Fermentation, as Spirit of Wine, Corn-Spirits, and Spirit of Juniper-berries, &c. Or by Confermentation, as Spirit of Roses with Sugar, Spirit of Elder-flowers with new Beer: Or by Abstraction, as Spirit of Lillies of the Valley, along with Wine or Spirit of Wine; and the various apoplectic, anti-epileptic, anti-hysterical, &c. Waters.

2. Sulphureous Productions of a mean Consistence include, 1. The Essences and Extracts prepared chiefly from Vegetables. 2. Expressed Oils.

3. The dry and solid sulphureous Productions are the Rosins of Jalap, Scammony, the Lac Sulphuris, Flowers of Sulphur, of Benjamin, Cinnabar, and Phosphorus.

III. Earthy Productions are, 1. Either entirely fixt, as diaphoretic Antimony, Ceruss of Antimony, Bezoar mineral, the *Terra vitrioli dulcis*, the various Crocus's of Iron, of Copper, Shells prepared and calcined, burnt Hartshorn. 2. In part volatile in the Fire, as Crocus Metallorum, Glass of Antimony, Regulus of Antimony, Mercurius Vitæ, Luna cornua, Plumbum cornuum, and most of the Magisteries prepared by Precipitation.

The



An Account of the Chemical Writers.

1. **C**HEMISTRY is the Art of separating natural Bodies and their Parts, purifying and combining them, and of rendering them fitter for medicinal and other useful Purposes in Life.

2. And thus Chemistry is twofold, either Physico-mechanical, or Medico-pharmaceutical.

3. The former is without dispute more ancient than the latter; and when it has for its Object not so much the Fusion and Separation, as the Exaltation and Transmutation of Metals, it is then called Alchemy.

4. And thus we may make three Classes of Chemists and Chemical Writings. The first treat of Alchemy, or of the Exaltation and Transmutation of Metals: The second, on Metallurgy, or the Smelting, Separating and Assaying of Metals; as also on the Art of Glass-making, Enamelling, Lackering, Dying, Soap-boiling; nay, even on the Arts of

B 4 Brewing,

Brewing, Cookery, and Baking: The third and last, on Pharmacy, or the Preparation of Medicines. Yet Chemistry may be more commodiously divided from the Consideration of its principal Operations, rather than from its Scope and End, into Zymotechny, Halotechny and Pyrotechny. To the latter do properly belong the Metallurgic Operations: To the second, Solutions, Precipitations, and the Productions thence arising by means of Salts; and to the third, Fermentation and the Effects thereon depending.

5. *Borrichius* has, in his *Conspectus Chemicorum illustrium*, given us a List of the Writers on Alchemy, together with a short Critic annexed.

6. The principal and most noted Alchemists among the Ancients are, *Hermes Trismegistus*, *Geber*, *Artephius*, *Arnoldus de Villa Nova*, *Raymond Lully*, and *Bernard Count of Trevisa*: Among the Moderns, *Alexander Van Suchten*, *Sendivogius*, *Philaletha*, *Mich. Mayer*, *Espagnet*, and *Pantaleon*. See more below, §. 11.

7. *Basil Valentine*, *Isaac Hollandus*, and *Theophrastus Paracelsus* were the first who taught how Chemistry, that had hitherto been almost entirely employ'd on the Exaltation

tion and Transmutation of Metals, might with Advantage be applied to the Preparation of Medicines.

8. But such Attempts met with great Opposition from many, who pretended that most Chemical Preparations gain from the Fire too great a Degree of Dryness and Violence, nay even a secret Poison: Whence it caused a long Struggle, before chemical Medicines could be sufficiently legitimated, and unanimously introduc'd into the Shops. But in particular, *Thomas Erastus*, *Gabriel Fontanus*, and in the last Century, *Herman Conringius* were the warmest in the Opposition: The latter however was solidly refuted by *Borrichius*, partly in his Dissertation *de Ortu & Progressu Chemicæ*, and partly in a peculiar Treatise *de Hermetis & Veterum Ægyptiorum Sapientia*.

9. *Dan. Sennertus*, *de Galenicorum & Chymicorum. Con. & Dissensu*; *Laur. Hoffman de Remediorum Chymicorum vero usu & vero abusu*; and *Schraderus de Remediorum Chymicorum pariter ac Galenicorum necessitate*, took upon them the Part of Moderators in the Dispute.

10. The following Authors however have gained the greatest Reputation in pharmaceutical

tical Chemistry, viz. *Crollius, Quercetanus, Beguinus, Hartman, Poppius*, and his Commentator *Agricola, Petrus Job. Faber, Angelus Sala, Mynsicht, Zwelfer, Van Helmont, Tachenius, Michaelis, Etmuller, Fr. Hoffmann, Rolfinckius & Poterius*: Among the Moderns, *Febure, Glafer, Lemery, Le Mort, Barckhuysen, Juncken, Cardilucius, Ludovici, Wedelius, Bobnius, Stifferus & Fr. Hoffmann, jun.*

II. The Writers on Metallurgy or the Physico-mechanical Chemistry, are much the fewer in Number. And those who have treated of Metallurgy, as *Ulysses Aldrovandus, George Agricola, Encelius*, and others, have done it rather as Historians. Yet *Laz. Ercker, Becher*, and his Commentator, *Stabl*, the honourable Mr. *Boyle, Kunckel, Glauber*, and several anonymous Authors published by *Kelner*, furnish an useful Introduction to the Art.

Alchemical Writers are either,

I. *Nomenclators and Censors*; as *Borrichius* in his *Conspectus Chymicorum illustrium* already quoted, and the Author of the Treatise entitled, *Feg-feur der Chemisten*, the Chemists Purgatory.

II. Editors and Collectors of Pieces of different Authors; as *Joach. Tanckius, Job. Tholden*,

Tholden, Nathan Albinæus, Horlacher, Mangetus, the Editors of the *Theatrum Chymicum*, *Ars Aurifera*, *Vellus Aureum*, and the *Musæum Hermeticum*.

III. Theoretical Writers; as *Petrus Bonus Lombardus* in his *Margarita pretiosa*, *Clauderus de Tinctura Universalis*, *Morbofius* and *Cramer* in their *Differatations de transmutatione Metallorum*, *Becher* in his *Supplem. Ildum Phys. Subterræn.* *Wedelius* in his *Introductio in Alchymiam*, *Filius Sendivogii*, and *Nuyfiment de Sale Philosophorum*, *Baron Schroedter* in his *Bedencken vom goldmachen*, *Thoughts on gold-making*, *Wayz* in his *Bedencken von der Alchymie*, *Thoughts on Alchemy*, as also the Author of the *Chymischen Zeig-und Wegweisers*, *Chemical Guide*, and the three small Treatises lately published; the first entitled, *Mineralisches gluten*, mineral glowing Coals; the second, *Philosophisches perlen-baum*, philosophical Pearl-tree; the third, *das eröffnetes Cabinet der Natur*, the Cabinet of Nature opened.

IV. Classical Authors; as *Hermetis Trismegisti Tabula Smaragdina*, *Senioris Zadith Tabula Chymica*, *Geber*, *Arnoldus de Villa nova*, *Raymond Lully*, *Bernard Count of Trevisa*, *Roger Bacon*, *Ripley*, *Basil Valentine*,
Theo-

Theophrastus Paracelsus, Sendivogius, Espagnet, Flamellus, Bazdorff's filum Ariadnes.

V. Controverted Adepts; as *Augurellus, Rupefissa, Philaletha, Pantaleon, Monteschnyder, der grosse und kleine Bauer, Claveus, Christ, Democritus.*

VI. Anonymous Writers; as the Authors of the *Turba Philosophorum, Rosarium Philosophorum, Clangor Buccinae, Cymbalum Aureum, Correctio Fatuorum, Consilium de Conjugio Massae Solis & Lunae*; as also, *das eröffnetes Philosophisches vater-bertz*, the philosophical Father's Heart opened; *Wasser Stein der Weisen*, Water-Stone of the Philosophers; *die Philosophischen Wassern*, the philosophical Waters, *via veritatis*, and the Treatise, *de Principiis Naturae & Artis.*

VII. Authors of a lower Class; as *Erbinæus von Brandau, Edward Kelly, Ulricus Poyseius, Danstenius, Dionysius Zacharias, Lambspring, Thomas Norton, and Naxagoras.*

VIII. Writers who have published particular Experiments; as *Cassius de Auro, Ræschius* in his *Experimenta Ostiandriana*, the Author of *Sol sine Veste, das Wunder-drey*, the wonderful three; *Alchymia denudata, die Beschreibung eines bey Zwickau gefundenen goldischen*

ischen Sandes, the Description of a Gold-Sand found near Zwickau.

IX. Process-retailers; as *Tanckius* in his *Promptuarium Alchymiae*, *Becher* in *Chymischen glucks-hafen*, chemical fortunate Haven, *Kessler* in his *Centuriae*, *Schmuck* and *Kellner* in the *Ærarium Chymicum*, *Neidhold* in the *Chymischen particular-Zeiger*, particular chemical Guide. And yet a Man need not regulate his alchemical Studies by this List or Order of Authors, as it is certain that the several Philosophers have had their own several Subjects, and consequently their several *Encheireses*, so that even an Adept might find it a difficult Matter to distinguish the genuine from the pretended Adepts; and hence it is Labour in vain, to attempt to reconcile the several Philosophers, as *Naxagoras* and others have proposed.

12. Now intending to treat Chemistry as a Physician, I shall confine myself principally to the pharmaceutical Branch.

13. Accordingly I shall divide the Work into two Sections; the first describing and exhibiting the Operations; the second, the chemical Productions.



SECTION I.

The Operations of Chemistry.

CHAP. I.

Solution and Extraction.

1. **SOLUTION** or Dissolution commonly denotes one thing's taking into itself, or absorbing another, in such manner as no longer to be distinguishable from each other, but together make up one Body.

2. Now this happens either in the humid, or the dry way; *i. e.* either by means of certain Liquors and Humidities; or, by things that are dry, yet fluxile in the Fire, particularly Salts.

3. Such a Liquor as absorbs other Matters, and thus dissolves them, is called a *Menstruum*, or Solvent.

4. Now such is common Water, Vinegar and other acid vegetable Juices, Spirit of
Wine

Wine, expressed and distilled Oils, the several Lixiviums of Lime and alkaline Salts; the urinous Spirits, acid mineral Spirits, Aqua fortis, Aqua regia, and Spirit of Salt, Spirit and Oil of Vitriol.

5. When not the entire Body of a thing, but a part only thereof is dissolved, we call that an *Extraction*.

6. Should now the Menstruum obtain a transparent red, yellow, green or blue Colour, that we call a *Tincture*; but in Case of an opaque, dark Colour, an *Essence*: tho' this Distinction be not always so accurately regarded.

7. To Extraction is reducible the drawing off Waters, Vinegar or Spirit of Wine from Simples, those carrying along with them over the Helm the Smell and Flavour of the Simple, tho' the Colour be not thereby changed in the least: And thus other Extractions, properly so called, exhibit no sensible Change in Colour; as Wine or Must, poured on Glass of Antimony, takes into itself something of the Substance thereof; as appears from its emetic Virtue, and also from its Precipitation, tho' its Colour remain unaltered.

8. But

8. But as it is of great Importance to know which Menstruum is most adapted to any Subject, that each may have its own appropriated Solvent, we shall subjoin some Remarks on this Difference.

9. Common Water is the fittest Menstruum for dissolving and extracting Salts, Gums; as Gum-arabic, Gum of the Cherry and Plum-tree; and Gum-rosins, as Gum-ammoniac, Bdellium, Sagapenum, Galbanum, Opopanax, &c. as also Gellies, or the subtile glutinous Parts of Vegetables and Animals.

10. Yet among Salts there is a Difference, in regard some are quicker and in greater Quantity dissolved than others; for Instance, alkali Salts, common Salt, Salt-petre and Vitriol readily dissolve in Water. On the contrary, the *Arcanum duplicatum*, *Tartarus vitriolatus*, and the like neutral Salts, with more Difficulty: the former it dissolves cold, but the latter hot; and for crude Tartar the Water must be boiling hot.

11. And this Observation may be of service, when such different Salts are found lodged together in one and the same Subject, and we would attempt to separate them, *e. gr.* Pot-ash, as not only *Stahl*, but even *Cardiucius* and *Kunckel* have observed, is not a
pure

pure alkali Salt, but holds also a large Proportion of a neutral Salt, resembling *Tartarus vitriolatus*; especially if it be exposed for some time to the Air, a great deal of the Alkali will be changed by the universal Acid lodged in that Element, and be reduced to such a neutral Salt. Upon dissolving the alkali Salt with cold Water, the neutral Salt remains behind, as a whitish grey Slime, which elixated with boiling Water, and filtrated hot, after cooling shoots into a considerable Quantity of a neutral angular Salt, entirely different from the other Salt.

12. And yet Water imbibes a certain Quantity only of such Salts as it otherwise readily dissolves; *e. gr.* one Pound of Water absorbs about six Ounces of common Salt; $\frac{1}{4}$ of an Ounce of Tartar; one Ounce of *Tartarus vitriolatus*; two Ounces of Nitre, as many of Vitriol, and a greater Quantity of each as they are more or less pure; and what is put into the Water over and above remains undissolved. But it is worth remarking, that upon throwing in a different Salt from what the Water is already saturated withal, *e. gr.* Vitriol or Salt-petre, it still absorbs a considerable Portion of these.

C

13. Vinegar

13. Vinegar dissolves all sorts of Earths, Corals, Crabs-eyes, Mother of Pearl, and other Shells; as also Iron-filings, and calcined Lead and Copper. It is also employed in dissolving and depurating the Gum-resins, as Opium, Gum-ammoniac, &c.

14. And even other acid vegetable Juices, as those of Lemons, Quinces, &c. supply the place of Vinegar; as does also Tartar dissolved in hot Water, and even Wine itself.

15. Spirit of Wine is the best Solvent for Resins; as Benjamin, Gum Sandarach, Mastich, Camphire, &c. In like manner it readily absorbs Salts impregnated with Oils, or Fats attenuated with Salts; as we see in Soap, which it dissolves in a considerable Quantity; whereas it does not readily absorb either Oils or Fats apart, nor pure alkali Salts.

16. And this is the Foundation of the Encheiresis for rectifying Spirit of Wine without Fire, or for its extemporaneous Dephlegmation. Thus upon throwing a dry alkali Salt, as Salt of Tartar, or Pot-ash, into the Spirit of Wine, you still suppose to hold Phlegm, shaking them together, and then setting them to stand for some time, the Phlegm with which the Spirit is still charged, dissolves the Alkali, falls to the bottom because of its Weight,
and

and the Spirit separating therefrom, mounts up to the top, and may be gently decanted off.

17. Yet the Spirit absorbs somewhat of the Alkali, as the Taste in part shews, and in part is manifest upon rectifying the decanted Spirit by the Alembic; for in that Case a good deal of Salt remains behind, tho' remarkably altered in its alkaline Nature: yet this Inconvenience may be obviated, by proportioning the Quantity of Pot-ash to that of the Phlegm, so as that this last shall be but just saturated therewith. In this Process the Pot-ash must be pretty dry; and notwithstanding all this, the Spirit rectified in this manner continues still considerably phlegmatic: And if you intend not the Alcalisation of your Spirit, but its accurate Dephlegmation, redistilling it is absolutely necessary; especially if you propose the making such Essences, as are to be used externally, as the Essence of Amber, &c. in which Case the saline alkaline Parts are of no service.

18. The Spirit absorbs a much greater Proportion of alkali Salts, if these are previously saturated with distilled Vinegar, or impregnated with distilled Oils, or cemented with Lime. Vid. *Præparationem Salis mirabilis*

Vateri. Tho' when the Alkali is first saturated with Vinegar, it is no longer to be called an Alkali, but a neutral Salt. These Extractions, from Herbs and Roots in particular, are certainly of great Use in Medicine; for as their peculiar Virtue lies commonly much dispersed among the earthy Parts; when they are prescribed in Substance, the Dose must be the larger, which in taking nauseates not only the Patient, but loads and hurts the Intestines, because of the superfluous earthy Portion: But in the Form of an Extract, this Inconvenience is obviated, the Dose smaller, and the Effect more immediate and safe. Now as these Reasons gave rise to the several Formula's of Essences, Extracts, Decoctions, and distilled Waters; in the same View also a great deal of Trash has been introduced into the *Materia Medica*; and that only from not knowing the Mixtion of Herbs and Roots, and from not considering wherein the peculiar Virtue of each Species is lodged, and endeavouring the Separation of that Part. For Roots and Herbs commonly bear in their gross woody Parts, either a resinous, a sulphureous, or even a slimy or gelatinous saline Substance, wherein their specific Virtues are properly lodged: and if for each a
proper

proper Menstruum be not employed, you miss of your End. For Instance, an Extract of Fumitory, Wormwood, the lesser Centaury, &c. with Water yields only a bare acid Juice; but if you would know what remains behind in the Plant, dry it gently, and extracting it with Spirit of Wine, you have an Essence, having the genuine Smell, Flavour and Virtue of these Herbs. Hence the best Manner of making such Extracts is, if instead of Water, the Herbs be macerated in Wine. On the contrary, if you extract the Root of black Hellebore with Spirit of Wine, you obtain nothing at all; but with Water, all its Virtue. Hence great Regard is to be had to the Smell and Taste of Herbs. Such as taste sharp and bitter, and smell strongly resinous, as the alexipharmic Roots and Herbs, *e. gr.* Root of Angelica, Vincetoxicum, Master-wort, Elecampane, &c. require a spirituous, and the other an aqueous Menstruum; but if with such a Menstruum you would only macerate, and afterwards express them, you must be heedful that the Evaporation be very gentle, and that the best Parts do not fly off.

19. Expressed as well as distilled Oils, no less than Spirit of Wine, dissolve Rosins, as

Camphire, Gum Sandarach ; nay also dissolve common Sulphur, which Spirit of Wine does not.

20. Urinous Spirits are not in general much employed in Solutions, tho' they sometimes dissolve better than the sharpest acid Menstruums; *e. gr.* acid Spirits dissolve not the Magisteries of the several earthy Subjects, which notwithstanding urinous Spirits do.

21. Among Metals, urinous Spirits most readily lay hold on Copper ; so that this is the quickest Method of assaying false Silver, or white Copper, and discovering whether any one Mixture or Ore hold any Copper; *viz.* if the Spirit poured thereon becomes of a blue Colour. The *Tinctura Lunæ* commonly found in the Shops, is only such a Solution of the Copper, which still remains in the Silver after Cupellation, and which could not be separated thereby : But if you further purify the Silver, the urinous Spirit will no longer take such a Tincture from it.

22. Urinous Spirits alone dissolve no Oils, or but sparingly ; but when directly united in Distillation with Spirit of Wine, they dissolve in a pretty large Proportion ; a Property necessary to be known, when you would make the *Salia volatilia oleosa*.

23. The

23. The Lixivia or Solutions of alkali Salts, especially when they are sharpened with Lime, dissolve common Sulphur, Orpiment, and Antimony, not only the sulphureous but the reguline Parts thereof, as *Borrichius* has observed in the *Acta Hassniensia*, T. II. Obs. 73. and further, both the Fat of Animals and expressed Oils, as may be seen in the Preparation of Soap; but distilled Oils, not without peculiar Encheireses.

24. Acid mineral Spirits are employed in dissolving and extracting Metals, the several earthy Subjects, Stones, and the like: Resinous Matters, as Wax, Pitch, Turpentine and Varnish they touch not. Hence the Workmen in etching, or engraving on Copper with Aqua fortis, first lay on the Plate a Ground of some resinous Substance or other, and afterwards lay bare the Plate in all the Places into which the Aqua fortis is to eat.

25. Aqua fortis or Spirit of Nitre dissolves Silver, but not Gold; but if you only add so much Sal ammoniac, or common Salt, as it can imbibe cold, it commences an Aqua regia, dissolves Gold and precipitates the Silver. Hence they are both called *Scheide-wasser*, Water of Separation or Depart, as they separate or part Gold and Silver from each other.

If to Aqua fortis, or Spirit of Nitre, you put highly rectified Spirit of Wine; or if only the red Fumes rising in Distillation be introduced into it, it then also dissolves Gold.

26. Aqua fortis and Aqua regis equally dissolve Quicksilver, tho' the former does so more readily than the latter; in like manner Copper and Iron, but with a violent Agitation and strong Heat.

27. Aqua fortis violently rushes on Tin, but corrodes it only to a white Calx, and dissolves it not without a particular Encheirefis; which notwithstanding Aqua Regis readily does.

28. If you would dissolve Lead, you must weaken or dilute your Aqua fortis with about three Parts common Water.

29. The same is also to be done to Oil of Vitriol, if you would dissolve Iron.

30. Oil of Vitriol cannot dissolve Copper, unless the Copper be either previously calcin'd, or otherwise open'd.

31. Oil of Vitriol dissolves not Gold in the common manner, but rather precipitates it out of other Menstruums, unless the Oil be, in a certain manner, previously prepared with the Gold; but dissolves Silver, when boiled therewith: whence some Artists employ it in separating Gold and Silver.

32. Oil

32. Oil of Vitriol does not touch Quick-silver, without previous Coction or Abstraction, and then it resolves it to a white and pretty fixt Calx, which, by pouring common Water thereon, takes a yellow Colour, and is then called mineral Turbeth.

33. Spirit of Salt, of itself, dissolves not Gold; but putting to it some Spirit of Nitre, or bare Nitre only, it readily dissolves it; neither does it dissolve Silver and Lead, but Copper, Iron and Antimony perfectly.

34. What is peculiar to this Spirit above other Menstruums is, that it renders its Solvents very fluid; so far that common Lime, which otherwise cannot be fused by the strongest Fire, becomes by its means an easily fusible Salt.

35. Amalgamation is also a Species of Solution, and holds a middle place between the humid and dry way; tho' it approaches nearer to the former than to the latter. It is true, running Mercury wets not Wood, Stones, Glass, or the Hands; yet to Metals it cleaves, as Water or aqueous Liquors do to the above-mention'd.

36. Among Metals, Mercury lays hold most readily on Gold; next to that, on Silver, Tin and Lead; but more difficultly on Copper:

per: on Iron, Bismuth and Regulus of Antimony, not at all.

37. Indeed when these last are combined with Silver, Tin and Lead, they in appearance give Ingress to the Mercury; but afterwards in Digestion it strikes them out.

38. Bismuth imparts to the Metals, with which it is combined, a peculiar Penetrancy, so as in part to make them pass thro' Leather; a thing otherwise not so easily procurable: But if this Amalgama be set at rest for some Days, the Bismuth spontaneously re-separates and rises a-top in a dry Powder; and the Metal remaining closely united with the Mercury, may pass with it thro' Leather.

39. To dissolve with Mercury or amalgamate Metals, it is proper previously to laminate, file them down, granulate or dissolve them in their appropriated Menstruums, and precipitate them with some other Metal, and not with Salts; for Salts attach to metallic Calx's, and hinder the Quicksilver from combining therewith; so that Quicksilver receives neither Silver nor Copper, precipitated with Salts; but perfectly well, when this has been thrown down with Iron, and that with Copper.

40. Amal-

40. Amalgamation, as likewise most other Solutions, is greatly promoted by external Heat.

41. To Solution in the humid Way is reducible *Deliquation*; which is when a dry Matter put in a moist Place relents in time, and turns to a Liquor: and this is called running *per deliquium*. This do all lixivious or alkali Salts; the *Terra foliata Tartari*, and common Salt, if previously calcined or melted; the *Sal-ammoniacum fixum*, Mercury-sublimate mixed with Tin, Iron, or Sal-ammoniac, Butter of Antimony, Vitriol of Iron, and generally all metallic and mineral Extractions made with Spirit of Salt.

42. This Deliquescence answers better in Summer, in the dry Air of a shady Place, or in a dry Cellar, than in too damp a Place; and is greatly promoted by powdering the Matter fine, spreading it abroad, and thus suffering it to stand.

43. Several Authors, especially among the Ancients, have observed, that this Manner of Solution, *viz.* when any Matter dissolves slowly of itself, is far preferable to the other Methods of pouring Water or other Liquors thereto, and hurrying the Solution; in regard the Salts, in the former Manner, repeatedly
run

run, and re-coagulated, gain an uncommon Degree of Fluidity and Penetrancy, not procurable the other way: As Salt of Tartar and fix'd Nitre become in this manner so fluid, that put in a Crucible on the Fire, they immediately pass through it, without leaving the least Trace behind. Hence *Isaac Hollandus's* Advice appears not so impracticable, when he says Salt of Tartar must be purified so long, till it become an Oil, no longer reducible to a Salt, by exposing it either to Cold or Heat.

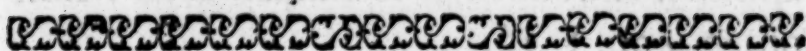
44. Solution in the dry Way is, when, for Instance, Salt of Tartar, Pot-ash, Nitre, &c. are melted, and Antimony, Sulphur, Arsenic, pounded Flints, Glafs, &c. are thrown into the Salts in Flux; the Salts rush on these Matters with a violent heaving and boiling, and imbibe them in such sort, that when the Salts are afterwards suffered to relent in the Air, or dissolve in warm Water, a good deal passes through the Strainer.

45. In particular, an Alkali, combined in this manner with a Sulphur, has a great Power of fluxing Metals, and even Gold. *Vid. Stalii anweisung zur Metallurgie in der dabey befindlichen Einleitung zur grund-mixtion*, p.406. §. 36. *Stahl's Elements of Metallurgy* in the annexed

annexed Introduction to fundamental Mixti-
on, p. 406. §. 36.

46. But otherwise it is all one, whether you first melt the Salt, and then throw into it what you intend to dissolve; or whether you first flux the Matter, and then throw the Salt thereon; or whether you mix and flux them together. The first Method suits best with volatile Matters, as Sulphur and Arsenic; the second, with fix'd and fusible Subjects, as Metals, and in some measure Regulus of Antimony; the last Method, with fix'd and unfusible Subjects, as Stones, Glass, &c.

47. Under this Head we are also to reckon such Dissolutions, as happen when metallic Calx's are put into molten Glass, or are melted with a vitrifiable Mass; and so dissolved by the Glass, as that this latter shall be tinged throughout; as from Gold a Ruby-red. Vid. Orschalck's *Sol sine veste*; from Copper, a Sea-green Glass; from Copper and Iron, a Grass-green; from Tin, a white Glass; from Lead, a yellow; and from Cobalt, an Azure-glass; so as thus to discover the Contents of any Ore. Vid. Glauber. *Furn. Philosoph.* P. IV. p. 18, 19. It. Kunckel. *Ars vitriar.*



C H A P. II.

Coagulation and Precipitation.

I. **I**T is not without Reason we subjoin Coagulation and Precipitation to Extraction and Solution; or rather set them in Opposition; as they are Counterparts, to each other: For Coagulation restores to a dry Consistence, what Solution had made pass from a dry Form into a State of Fluidity; and what Solution or Extraction had united with the Menstruum, is by Precipitation re-separated therefrom.

2. Inspissation, Evaporation, Abstraction and CrySTALLISATION are also different Degrees or Species of Coagulation.

3. For when either vegetable or animal Extracts and Solutions are not reduced to a dry Powder, a thing impracticable without the Loss of their best Virtues, but only to the Consistence of a thick Juice, this is called Inspissation; and such inspissated Juices eminently *extracts* The more gentle the Evaporation or Inspissation, the more the Extracts

tracts retain of the Virtues of their Simples : But the stronger the Fire, the more the finer volatile Parts evaporate ; so as thereby Asarum, Tobacco, Hellebore and Opium shall be almost divested of their emetic and narcotic Virtues.

4. When this Separation of the Menstruum is performed in an open Vessel, so that the Menstruum flies off and spends itself in Vapours, it is called Evaporation ; but if in close Vessels, that the Menstruum be again recover'd, Abstraction.

5. CrySTALLISATION has only place with regard to dissolved Salts ; for since Water, as we said above, can imbibe and hold a certain Proportion only of Salts, and hot Water dissolve more than cold ; it happens, that when in Evaporation the dissolved Salts are again deprived of their Humidity, they reassume their former dry and hard Consistence, separate from the Water ; and that at first on the Surface, as there the Humidity flies off more copiously, and form a saline Crust or Skin. Now if the Solution be set to cool and stand for some time, more saline Particles separate from the cooling Water ; and as in the superfluous Moisture they have still room to move, they settle orderly on each other, on the Sides and

and Bottom of the Vessel, and thus acquire a certain Figure, which in some Salts, as Saltpetre, nearly resembles Rock-Crystal; hence the entire Process is called *Crystallisation*: But on the contrary, when the dissolved Salts are violently boiled in, there only arise irregular saline Lumps or Masses.

6. Crystallisation is not only employed for purifying Salts, but also for separating them from one another; for Instance, genuine inflammable Nitre, with its acidish Salt, is separated from the alkali Salt of *Nitrum Antimoniatum*, or the common Saltpetre from the cubical fossil Salt it holds.

7. For in the Crystallisation of Salts we find a twofold Distinction; viz. one Species shooting sooner than another, and also into a different Figure; for Instance, the neutral Salts, as *Tartarus vitriolatus*, the *Arcanum duplicatum*, and the *Sal falsum* from Pot-ash, shoot much sooner than Alkali's, which *per se* are hardly or ever brought to crystallise: Saltpetre, Vitriol and Alum more readily than common Salt; which last, without a peculiar Encheiresis, is scarce ever disposed to shoot. Further, as to the different Figures of Salts; Saltpetre shoots into oblong Prisms, and common Salt into Cubes, Vitriol and Alum into polygonal Crystals.

8. To

8. To precipitate any thing, is no other than separating it, by the Addition of some other thing, from the Menstruum, where-with it is dissolved or extracted, so as to make it fall down to the bottom.

9. And as Solutions, as we said above, are not only accomplished by means of peculiar Liquors and Menstruums, but also by dry Salts fused in the Fire; so may Precipitation be performed not only in the humid, but in the dry way too.

10. For instance; when Lead, Bismuth, or Regulus of Antimony, are corroded by Salt-petre or alkali Salts, and in some measure dissolved, so as together with the Salts to constitute one uniform Mass; and you put some Iron-filings, or only some Charcoal-dust thereto, and fuse them along therewith, the metallic Matter re-separates from the Salts, and collects at the bottom of the Crucible in its original State; and hence such Additions as separate Metals from their Sulphur, and Flux-powders, are called Precipitants.

11. The following is given as a general Rule in Precipitation; *viz.* that each Matter is precipitated by its Opposite, *i. e.* an alkaline Solution by means of Acids, and *vice versa*; but it does not always hold: For

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often Alkali's and Acids mutually precipitate each other, *e. gr.* Aqua fortis precipitates Butter of Antimony; Spirit of Salt, the Silver and Lead dissolved in Aqua fortis; Spirit of Vitriol, the Solutions of earthy Matters made in Spirit of Salt, as we see in the Preparation of the *Magisterium Antepilepticum Michaelis*; Spirit of Urine throws down the Sulphur of Antimony, which has been extracted with an Alkali. Sometimes one Metal throws down another; thus Mercury precipitates Silver dissolved in Aqua fortis; Silver, Lead; Lead, Copper; Copper, Iron; and Iron, Crabs-eyes: Oftentimes bare Water alone precipitates, as we see in the Preparation of *Mercurius Vitæ*, and the *Lac cosmeticum*, tho' neither Acid nor Alkali be found therein.

12. But we are well to observe, that tho' a Solution may be precipitated by different Matters, yet it proves not all one, which Precipitant you employ; for the Precipitate acquires different Properties, according to the Difference of the Precipitant.

13. For Instance: Gold dissolved in Aqua regis, and precipitated with an Alkali or an urinous Spirit, yields an *Aurum fulminans*; but if you take a Solution of Vitriol to precipitate withal, you have a fine yellow Gold
Calx

Calx without any fulminating Quality; if you precipitate with a Solution of Mercury-precipitate, or Verdigrease; by pouring on much Water, you procure a sparkling gold Calx, wherewithal to paint and write. *Vid. Cassius de Auro*, p. 97. And according to *Glauber*, Tartar, nay even Rhenish, *Franconian* and *Misnian* Wines have the same Effect. If you pour on a Solution of Gold made with Aqua regis, and diluted with much common Water, some dissolved Tin; or if you only put into it clean Tin-plates, the Gold soon falls to the Bottom in a purple-coloured Powder; and this Gold-calx is the fittest for making the ruby-red Glass, or ruby-flux, which has been kept so great a Secret. *Vid. Sol. sine veste*, p. 27, and 84.

14. If with Spirit of Salt, or Salt-water, you precipitate Silver dissolved in Aqua fortis, the precipitated Silver-calx becomes highly volatile, and so easily fusible, as in the softest Heat to melt to a semi-transparent Mass, almost resembling Horn, whence its Name, *Luna cornua*; the same thing also befalls Lead dissolved in Aqua fortis, and precipitated in that manner. But if you precipitate with Oil of Vitriol, or with an Alkali, the precipitated Calx is far from being so volatile and

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fusible.

fusible. Yet the Salts employed in the Precipitation attach thereto so strongly, that running Mercury difficultly receives this Calx, or amalgamates therewith; which yet readily happens, if the Silver be thrown down out of the Aqua fortis with Copper, or running Mercury.

15. Mercury dissolved in Aqua fortis, and precipitated with Spirit of Salt, or with Salt-water, also yields a white Calx, which is therefore called white Mercury precipitate, or *Mercurius cosmeticus*. If you employ a fix'd Alkali, you have a dark-red Precipitate; if Copper or Iron, your Mercury is revived.

16. Further, there is much in observing the due Proportion; *e. gr.* if on a Solution of Copper made with Aqua fortis, I drop Spirit of Sal-ammoniac or of Urine; at first indeed a good deal falls down, but if I pour more Spirit of Urine thereon, so as that it predominates, it re-dissolves the Precipitate; and the entire Solution, which before was only green, gains a beautiful Sky-colour. On the contrary, when on a Solution of Silver in Aqua fortis not highly saturated, a little of the Spirit of Sal-ammoniac, or urinous Spirit is dropt, there precipitates nothing; but if the Solution be deeply charged, some
of

of the Silver falls down : And if you go on with dropping in the urinous Spirit, the whole will be re-dissolved. And this is also the Reason, why it is not all one, whether, *e. gr.* I pour a Solution of Iron in Aqua fortis on an alkaline Solution, or this on that : since in the first Case, both Solutions incorporate without Precipitation ; and in the latter, precipitate each other : but this may be soon remedied by pouring on more Alkali so long till it predominate ; for here the Matter principally turns on the different Proportions : And thus two opposite Solutions may be incorporated or combined, if we only mind the proper Proportion.

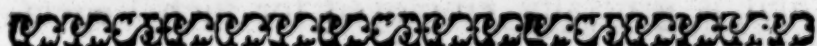
17. In several Precipitations there is also a remarkable Difference observable between what falls down first, and what last ; *e. gr.* if you precipitate a Solution of Vitriol with an Alkali ; or a Lixivium impregnated with Sulphur of Antimony, by an Acid ; what falls down first is much darker and grosser than what last, which is much finer and lighter in Colour.

18. It is worth observing, that most Precipitates do not re-dissolve in their former Menstruums : Some again re-dissolve, but are not again precipitated by the former Pre-

precipitant; *e. gr.* If you throw down Mercury-precipitate, which is no other than a Mercury dissolved in concentrated Spirit of Salt, with Oil of Tartar *per deliquium*, it falls down a dark-red Powder. This Powder indeed may be again dissolved in a strong Spirit of Salt, but not again precipitated with Oil of Tartar *per deliquium*. Vid. *Stahl's Anweisung zur Metallurgie in der dabey befindlichen einleitung zur grund-mixtion*, p. 367. §. 154. *Stahl's Elements of Metallurgy in the annexed Introduction to fundamental Mixtion*, p. 367. §. 154.

19. We shall here only add this one thing, *viz.* that in Precipitations we are not only to preserve and examine the Precipitates, but the remaining Liquor too: For in evaporating, it generally yields much Salt, which is sometimes of greater Value than the Precipitate itself; *e. gr.* on precipitating alkaline Solutions with Oil or Spirit of Vitriol, you procure a *Tartarus vitriolatus*; if with Spirit of Nitre or Aqua fortis, a *Nitrum regeneratum*; if with distilled Vinegar, a Salt like the *Arcanum Tartari*. Upon precipitating any Solution made in Oil of Vitriol, Spirit of Salt, or Spirit of Nitre, with Spirit of Urine, we obtain a subtile Sal-ammoniac; and when
the

the Evaporation, or even the Precipitation, is performed in close Vessels, as a Cucurbit furnished with its Head and Receiver, we generally procure a fine Spirit, which most People, as it is not acid, look upon as an useless Phlegm, and thus disregard it: yet if we take the trouble to precipitate with an Alkali any Solution made in Spirit of Nitre or Aqua fortis, and gently draw off the Phlegm in a Cucurbit, a sweet Spirit, like Spirit of Wine, comes over in fatty Veins.



C H A P. III.

*Digestion, Maceration, Fermentation, and
Distillation.*

1. **S**OLUTIONS and Extractions are not a little promoted by Digestion and Maceration; and both these, together with Fermentation, must generally precede Distillation; and hence it will not be unprofitable briefly to touch on them in this place.

2. To digest, or set any thing in Digestion, is to expose it for some time to a moderate Heat; to the end that the Menstruum

may the better imbibe the Subject to be dissolved or extracted, open it, and incorporate therewith.

3. For this reason the Heat should never be so strong and violent, as to make the Matter in Digestion boil; unless you digest in Cucurbits furnish'd with their Heads and Receivers, otherwise you lose the best Parts, or endanger your Glassess.

4. Maceration is often performed without Fire in a temperate Place, as a Stove or Chamber, where the cold Air has no Access; and is generally employed for such Vegetables, as we would by this soaking render fitter for Distillation.

5. Fermentation, according to some Authors, includes also Putrefaction, or rather is the first Degree or Step towards it, and denotes a soft and leisurely Dissolution of a Thing; whereby the included Spirit is, by means of Fire, and the Warmth of the Air, brought into Motion, and disengaged from the earthy and viscid Parts wherein it is entangled; so as now not only to discover itself by the Smell and Taste, but also in a somewhat stronger Degree of Heat to be separated by Distillation.

6. And

6. And according to the different Degree of Fermentation, or Difference of the Subject; now an inflammable, again an acid, and then an urinous Spirit is produced, of which before the Fermentation no Trace could be discover'd in the Subject.

7. And tho' Must, Honey and unfermented Wort be boiled or evaporated ever so much, they yield no Spirit, but an insipid Water only. On the contrary, after Fermentation, both Wine, Mead and Beer give forth an ardent Spirit; if the Fermentation be continued further, so as that they become a Vinegar, in the Distillation you procure no ardent Spirit, but an acid one. Thus Urine too, if inspissated or evaporated fresh, yields nothing but a weak Phlegm; but if it has stood for some Weeks in a temperate Place, and is thus brought to ferment and putrefy; in a soft Bath-heat there comes over a highly volatile saline Spirit, from which the other urinous Spirits take their Denomination.

8. For further Information on this Head, you may consult *Willis* and *Kergerus de fermentatione*; also *Stahl's Zymotechnia fundamentalis*, and *Becher's Phys. subterranean*. §. v. c. 2.

9. To

9. To distil, literally denotes a trickling down in Drops; and in this Sense it includes Filtration also: As it was no unusual thing with the Ancients, to order, when any thing was to be filtrated, the distilling of it thro' the Strainer; tho' they also used a quite different Method of Filtration than we do, and which rather deserves the Name of Distillation. Vid. *Geber. Lib. I. P. IV. c. 49. p. 97.*

10. But Distillation properly denotes the driving over, by means of Heat, the aqueous, oily and spirituous volatile Parts from the more gross, earthy and fix'd, in the Form of a Fume or Vapour; so as afterwards to re-condense and collect together into Drops in the somewhat cooler Head or Receiver.

11. Now this may be done three several ways: 1. *Per Descensum.* 2. *Ad Latus*, or by the Retort. 3. *Per Ascensum*, or by the Alembic.

12. Distillation *per Descensum* is performed as follows: Two earthen Pots, that exactly answer, are whelmed one over the other, and a perforated Plate or earthen Colander placed between them; the Subject is put into the upper Pot, and the Junctures being well luted, the lower Pot is set deep in the Earth, and then the upper is beset round with

with Fire, and at last quite buried in live Coals. Some recommend this Method of Distillation for Subjects that difficultly, or do not at all rise upwards; for Instance, Oil of Vitriol, in order to have a large Quantity of it, Mercury forced out of Antimony; but generally the Distillation *ad Latus*, or by the Retort, is used for this purpose.

13. A Species of Distillation by Descent, is that used for burning out, or procuring Tar and Pitch from the Pine; and also that other employed by good Housewives in distilling their Rose-water by means of an earthen Pan.

14. There is further this Difference in Distillations, *viz.* that they are either performed in a naked Fire, where the Flame is in immediate Contact with the distilling Vessel; or where there is an interposing Medium, as Water, Ashes, Sand, Iron-filings, &c. which first receive the Heat from the Fire, and afterwards communicate it to the Vessel.

15. The interposing Matters most in use are Water and Sand: The first is applied in different Manners; thus, either the Vessel is exposed to its Vapour, and this is called *Balneum Vaporis*, or *Roris*; or it is plunged in the Water, and called *Balneum Immersionis*, or *Maris*,

Maris, and corruptedly *Balneum Mariæ*: And in this last Case, the Glas is loaded with a Ring of Lead, that it may sink, and not rise up out of the Water; and sometimes chopt Straw or Chips are put into the Water; partly for the Vessel to stand the firmer, and partly to prevent the too quick Evaporation of the Water.

16. We commonly use dry Sand; some however moisten it with Water, to prevent the Matter to be distill'd from burning to; but when we have any such Suspicion, it is better to distil by a Bath-heat.

17. In general, the Difference between the above-mention'd Methods of distilling, and the Choice of that which is most proper for each Subject, depend on the following Particulars: 1. Such Subjects as are apt to rise readily, or froth and boil over, distil best *per Ascensum*; i. e. by the Cucurbit or Alembic; but such as rise with Difficulty, are best forced off by Descent, or by the Retort. 2. Such Matters as require a strong Heat, must be urged in a naked Fire. 3. Such Subjects as are apt to burn to, and acquire a nauseous Smell and Taste, as almost all vegetable and animal Subjects do, when drawn off in Sand to Dryness, must be distilled by a Bath-heat.

heat. 4. Sand gives a greater Degree of Heat than Ashes, but thereby Glass-vessels more readily burst: and consequently when you have this to fear, and you would draw off to Dryness any fluid Matter, but particularly saline Liquors, you may employ Ashes or Lime that has relented in the Air; or when you would not have too great a Degree of Heat, a Bath-heat.

18. Thus acid mineral Spirits, Spirit of Nitre or Aqua fortis, Spirit and Oil of Vitriol, the Spirits from Guaiac, Oak, Tartar, Soot, Hartshorn, &c. are for the most part distilled in a naked Fire: Butter and Cinnabar of Antimony, corrosive and sweet Mercury-sublimate, the Liquor C. C. Succinatus, &c. are generally distilled, sublimed and rectified in Sand: The odoriferous Waters from Flowers are distilled in *Balneo vaporoso*: Urinous and inflammable Spirits are distilled and rectified in *Balneo maris*. Yet often the one Method may be substituted for the other; as the Spirits from Woods, Tartar, Hartshorn, and also those of Nitre and Salt may well be forced off in Sand; Spirit of Vitriol alone requires almost indispensibly a naked Fire. Urinous and inflammable Spirits and distilled Oils may be also abstracted and rectified in Sand.

19. We

19. We had almost forgot to mention the *Venter Equinus*, or Horse-dung, so much cried up among the Ancients; yet for it you may substitute the Mark or Husks of Grapes, Moss, wet Grass and Hay, after heating upon each other. And indeed for the soft opening of many things, an Operation to be promoted by a constant Digestion and leisurely Putrefaction, the Warmth of Dung has something in it peculiar, as it approaches nearest to the vital Heat; only you must shift your Dung every eight or ten Days; and if you have not the Opportunity of so doing, you may use instead of it the *Balneum vaporosum*.

20. As to the Vessels employed in Distillation, we are to observe that those of Glass are certainly the best sort: But when at the last such a Degree of Fire must be given, as might otherwise melt the Glass, earthen Vessels are fittest; burnt pretty hard to obviate the Escape of the Spirits, as those of *Waldenburg* are; and that they may not so readily crack, they are first to be well coated over with a good Lute: the same Precaution is also necessary for Glass-vessels, not only in a naked Fire, but when exposed to a strong continued Heat in Sand. When a large
Quantity

Quantity of fluid Matters are to be distilled, it is generally done in a tinned Copper-Alembic; and such a Vessel answers pretty well for Brandies, and most distilled Waters: but if there be any Acid therein, the Distillation, or at least the Rectification should be performed in Glass-bodies. Iron-vessels are not often employed, unless for distilling Aqua fortis, or for the Revivification of Mercury, and the forcing it from its Ore: And this way the trouble of purifying the Aqua fortis by Precipitation for the Depart is saved.

C H A P. IV.

Rectification, Dephlegmation, and Concentration.

1. **R**ECTIFICATION is a repeated Distillation, whereby the Subject is freed either from its superfluous Phlegm, or earthy Impurities, and thereby render'd clearer, more pleasant and strong.

2. And thus Rectification differs not greatly from Dephlegmation, only that it is somewhat more extensive, and includes the Separation of the earthy Parts; whereas Dephlegmation

mation has for its Object only the Separation of the useless and superfluous Phlegm.

3. To do these things in a proper manner, we must, in the first place, cast about for some Marks or Characters, whereby to distinguish the useless Phlegm from the other spirituous and efficacious Parts, and then duly advert, in what Case the Phlegm comes over first, and in what last.

4. As to the first, the Taste is usually made the Touch-stone; and what consequently has no peculiar Taste, is looked upon as an inefficacious and useless Phlegm; yet this Proof does not always hold, as *Cassius* has shewn *de Auro*, Cap. X. p. 109. of the Phlegm of Aqua fortis; and *Becher* in his *Phys. subterr.* L. I. c. 3. §. 11. p. 78. of an insipid Water distilled from a certain sort of Clay: Besides, their not congealing in the keenest Winter Cold, which is otherwise peculiar to Water, affords a sufficient Argument, that such insipid Phlegms are something more than common Water. We must therefore call in other distinguishing Marks; for Instance, in distilling and rectifying inflammable Spirits, so long as you observe fatty Veins in the Still-head, what comes over is in no wise an useless Phlegm, tho' insipid:
And

and what in distilling mineral Salts heats the Receiver so much, and in rectifying yields very small Drops, is also no jejune, feeble Phlegm, but a highly subtile Spirit.

5. As to the second thing, the Order in which the several Parts rise; in distilling for urinous and inflammable Spirits, as also for odoriferous Oils and Waters, the noblest and best Parts usually come over first; in distilling for Vinegar, Aqua fortis, Spirit of Salt and Vitriol, the strongest acid Spirits rise last: I say, the acid Spirits; for as we already hinted, there comes first of all a subtile and penetrating Spirit, but not sensibly acid, and therefore generally thrown away as an useless Phlegm; as *Paracelsus Oper. T. 1. p. 879.* has remarked and corrected this Mistake with respect to Oil of Vitriol: And therefore in rectifying these Spirits we should observe this Order; first, receive apart the volatile Spirit, then throw away the intermediate Phlegm, and at last force over the acid Spirit. Yet as to Spirit of Vitriol, we are to observe, that all of it comes not over the Helm, but a good deal of a thick and heavy Liquor remains behind, therefore called Oil of Vitriol; and which must be rectified by the Retort, set either in *Capella vacua*, or
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the Neck buried deep in Sand, and placed hanging or inclining, in regard it otherwise unavoidably bursts.

6. In rectifying Spirit of Wine we are to observe, that it is done with or without Addition; with Addition, as either in drawing it off from Salt of Tartar, Pot-ash, and unslack'd Lime; that these Matters, which are otherwise great Absorbents of Humidity, may the better keep back the Phlegm; or putting other Things into it, to give it a finer Odour and Flavour. Thus some have the Art of communicating to common Malt-Spirits, after Rectification from Lees of Wine, the Smell and Taste of a Rhenish Brandy. Common rectified Brandy has a fine Odour from Amber, Mastich, Benjamin, Aloes-wood, and other resinous Matters, when drawn from them; with the Addition of some Salt of Tartar, or pure Pot-ash. It is a very good way to rectify Spirit of Wine upon the Simple, from which we would afterwards extract with it an Essence or Tincture.

7. And yet these different Methods are by no means to be confounded, but the most proper for the present Purpose to be pitch'd on; for Example, Spirit of Wine drawn off an alkali Salt is not near so strong and burning

ing in Taste as when rectified *per se*; wherefore it answers not so well for such common Aqua Vitæ as we would have very strong; on the contrary, best of all for the Preparation of Medicines, or for external chirurgical Applications; yet not for vulnerary Essences, to be poured into Wounds; on which account also the common Essence of Amber cannot be employ'd. Spirit of Wine rectified without Addition answers best for extracting vegetable Purgatives; but if it be impregnated with an Alkali, especially if extemporaneously dephlegmated, as we mentioned above, by putting Pot-ash into it, and only decanting it off, without once rectifying, it deprives the strongest Purgatives, as Jalap and Coloquintida, of all their cathartic Virtue.

8. In rectifying Vinegar we also sometimes add some common Salt, as it is observ'd to be considerably strengthen'd and sharpen'd thereby, and by this means the sooner and better to lay hold on Glafs of Antimony, or other Things you would extract therewith, than if it were rectified *per se*; but you must put no more Salt therein than what the Vinegar fully dissolves, for that is the true Proportion.

9. Concentration is a Species of Dephlegmation, and principally performed three se-

veral ways. 1. By Coⁿgulation. 2. Styptic Earths. 3. Alkali Salts, which imbibe the acid Spirits, and after separating the Phlegm, let go the Spirits by a strong Fire, or by means of Oil of Vitriol.

10. Concentration by freezing is described by *Stahl* in his *Observationes Chymico-Physicæ* for the Month of *October*; and he gives Instances in Wine, Beer, Vinegar, Urine, and salt Water; *e. gr.* Take a Quantity of the Liquor you would concentrate, as about two Measures, put it in Winter Weather in a Place where it may freeze, and let it stand for a Night, or in a keen Frost for a few Hours only, that about a Third or Fourth may congeal; and thus the superfluous Water or Phlegm is froze, and the strongest and best Parts amass together in the Center, and are drawn off by perforating the Ice; and this Liquor may be again set to congeal once or more times, the oftner the better; and thus from a poor *Thuringa* Wine you procure a strong sort, resembling Sack in Odour, and in part in Flavour, and which keeps much better than the best Wine. And the Beer concentrated in this manner surpasses the double *Brunswick* Mum; as may be seen at large in the above cited Place.

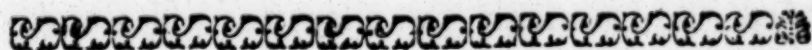
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11. The second Method of Concentration is described by *Glauber* in his first Century, and chiefly applied to mineral acid Spirits; for upon dissolving Iron, Calamy, Zink, &c. in a Spirit of Salt or Nitre, and distilling the Solution in Sand from a glass Retort, above half the weak Phlegm goes over, but all the acid Spirit remains behind in the Iron, Calamy, or Zink, till at last the Retort begins to glow, when at length the corrosive Spirits themselves come over in form of a ponderous Fume; and then the Receiver is to be shifted, and this concentrated Spirit received apart, which is certainly much stronger for Solutions, Fixations, and other Operations, than it was before, but keeps not well, and in pouring out is apt to evaporate or fume away.

12. The third Method has hitherto only been employed on distilled Vinegar, yet doubtless it might be also extended to other acid Spirits; the way is to saturate Salt of Tartar, or other pure alkali Salt, with distilled Wine-Vinegar, in the manner we make the *Terra foliata tartari*. This Alkali charged with the Vinegar is put into a glass Retort, along with its Weight of Oil of Vitriol dropt thereon, or calcin'd Alum, or Vitriol

calcin'd, the Retort put in a Sand-heat, and by the slightest degree of Heat there rises a highly concentrated Spirit of Vinegar, not obtainable by any other Method; the remaining Salt gives a *tartarus vitriolatus*. The reason of the Process is, that the Salt of Tartar, or the Pot-ash, absorbs the distilled Vinegar, the bare insipid Phlegm going off in Vapour; and this is the Acid concentrated and set free from its Phlegm. Now upon adding the Acid of Vitriol, this, as being a stronger Acid than Vinegar, lays hold on the Alkali, and again disengages it from the more subtle Acid, the Vinegar; so that the Acid of Wine is again set free, and comes over in a concentrated Form. But the reason why the Acid of Wine is separable, and remains not blended with that of Vitriol, is, that the Acid of Vitriol holds dissolved in itself a grosser Earth than the Vinegar, and consequently of a different Mixtion from the Vinegar; whence they cannot radically enter into each other, especially as the Earth of the Alkali stands in the next degree with the Oil, and thus more readily cleaves thereto; as it also very firmly adheres to this Earth, and will not suffer itself easily to be separated therefrom. And this too is the reason why
in

in distilling Aqua fortis or Spirit of Nitre we add Bole, Vitriol, or Oil of Vitriol, without which little or no Spirit is procurable.



C H A P. V.

Sublimation, Volatilisation, and Fixation.

1. **W**HAT Distillation is in aqueous and humid Liquors, that Sublimation is in dry Subjects, *viz.* when any thing is raised upwards by the Force of the Fire in form of a Fume or Vapour, yet condensing not into Drops, but settling as a Meal, Flour, or hard Crust, in the Neck of the Cucurbit, or in the Helm, or in appropriated subliming Pots, this we call Sublimation; what settles as a porous, loose Powder, is called Flowers; what, as a firm and compact Body, a Sublimate.

2. Sublimation is twofold, *viz.* according as the Subject to be sublimed is of itself volatile, or made so by the Addition of other Matters.

3. To the first Class belong Antimony, Arsenic, Sulphur, Sal-ammoniac; and above

all, Quicksilver, Cinnabar prepared from it, corrosive Mercury sublimate, and *Mercurius dulcis*.

4. Now as these last are the most used in Medicine, we shall give them as an Instance of Sublimation. Mercury-sublimate rises the readiest and the highest, Cinnabar the most difficultly, and *Mercurius dulcis* in a mean degree between the two; and accordingly the Vessels and the Regimen of the Fire are to be determin'd. Mercury-sublimate may be raised in glass Bodies in a Sand-heat; but Cinnabar requires almost a naked Fire, or to be sublimed by a considerable degree of Fire in small Bodies set in Crucibles; the Sublimation of *Mercurius dulcis* may be done both ways.

5. In subliming *Mercurius dulcis* there generally rises much running Mercury, which mixes with the *Mercurius dulcis*, and gives it an opaque grey Hue; to obviate this, the Fire is not to be hurry'd, and then the crude Mercury rises first, and settles in the Neck of the Glass, next above the Sand; upon observing which, the Sand may be removed two Fingers Breadth, and the *Mercurius dulcis*, which rises after the crude Mercury, finds room where to fix; otherwise it settles on the
crude

crude Mercury that rose first, and so it becomes tinged grey; yet this does it no great Harm, and it may be remedy'd, if over-look'd at first, by a second Sublimation; but *Mercurius dulcis* must not be often sublimed, as thereby it loses of its cathartic and diaphoretic Virtues.

6. In subliming Cinnabar on the contrary, if only the Mercury be first well incorporated with the Sulphur, nothing is to be apprehended from the Violence of the Fire; but the stronger it is, the quicker the Cinnabar rises, and the more beautiful its Colour.

7. To the second Class belong all such Subjects as are of themselves fix'd, but which being mix'd with other volatile Matters, afterwards ascend along with them either totally or in part; and this therefore may not improperly be called a Volatilisation.

8. Tho' almost all Subjects may thus be volatilised, nay, even Gold itself, as *Cassius De Auro*, p. 107. testifies, be sublim'd into Purple Flowers; yet the Sublimation of Hæmatites, Iron, and the *Caput mortuum* of Vitriol is the most usual sort; the subliming of Tin and Copper, Corals and Granates, in the manner mentioned, being a thing not so common.

9. Sal

9. Sal Ammoniac is what is commonly used for subliming the above mention'd Subjects; and that either the common sort prepar'd from Urine, Soot, and Sea-salt; or after *Glauber*, that from Oil of Vitriol and Spirit of Wine, which is a good deal sharper and stronger; yet in many Cases Mercury-sublimate, nay, even common Sulphur or Arsenic, may be employ'd for this End: As *Basil Valentine* in his *Triumphal Chariot of Antimony*, p. 420. teaches how to make a sparkling red Sublimate, on a Footing equal with the best Ruby, from Antimony, Arsenic, Cinnabar, and *Crocus Martis*.

10. It is worth observing, that upon re-subliming or rectifying such Sublimates, there generally remains behind a good Proportion of them in a fix'd State; and then this is a Species of Fixation.

11. Fixation is also twofold; either as Subjects, which were before volatile, may become totally fix'd, and be made to endure the Fire; or as they may abide a more considerable degree of Heat than they could before, tho' at last in a strong Fire they too ascend or evaporate; the former we may call a plenary, the latter a gradual Fixation.

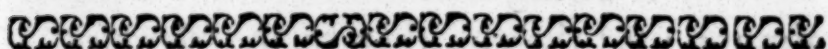
12. Thus

12. Thus almost all Precipitations of Mercury are gradual Fixations only; for tho' mineral Turbeth, or Mercury fix'd with Oil of Vitriol, can, e'er it rises, stand a degree of Fire that melts Glass, yet it not only fumes away in a naked Fire, but in earthen Retorts or Bodies may be forc'd off totally as a white Sublimate. Much the same is it with the *Arcanum Corallinum*, or the red Precipitate made with Aqua fortis. *Musitanus's Mercurius diaphoreticus* comes somewhat nearer to a compleat Fixation, tho' what remains fix'd thereof, is owing more to the Butter of Antimony used therein, than to the Mercury.

13. So that among all the Operations we know of, this affords the clearest Instance, how a highly volatile Substance may again be render'd fix'd in the Fire, and bear Ignition and Melting, viz. by pouring on Butter of Antimony three Parts Aqua fortis or Spirit of Nitre, yet heedfully, as it is apt to conceive a violent Incalescence; drawing off again the Spirit of Nitre in a Sand-heat, and repeating this several times, always taking fresh Spirit of Nitre thereto, thus it not only acquires a considerable degree of Fixedness, but also instead of its former emetic, a diaphoretic

retic Quality, and is hence called mineral Bezoar.

14. *Balduin's Phosphorus*, fix'd Sal-ammoniac, and *nitrum regeneratum*, furnish an Instance of a very quick, yet lasting degree of Fixedness; as in the first, the Spirit of Nitre is fixed and connected with Chalk; in the second, with Lime; in the third, with Salt of Tartar or Pot-ash, in such manner as to endure Ignition and Melting; whereas before it would evaporate in a moderate Heat.



C H A P. VI.

*Calcination, Reverberation, Detonation,
Vitrification, and Cupellation.*

1. **T**O calcine, properly denotes the changing by means of Fire a firm and compact Body into a porous loose Powder, Calx, or Lime; and this sometimes happening by means of sharp saline Menstruums, is therefore analogically called also a Calcination.

2. When the Flame of a Fire is employ'd in Calcination, and the same so directed as to play

play all over the Matter to be calcin'd, this we call Reverberation. At the Mines they have another Species of Calcination, called Roasting, wherein they either underlay, or stratify the Ore with Billet-wood, and then set fire to the Pile; or they dispose of the Wood in peculiar Furnaces, so that the Flame may play thro' and all over the Ore, by being reflected back thereon.

3. It is observable, that many Things, as Lead, Regulus of Antimony, &c. become more ponderous by calcining; tho' it be certain they lose much in that Operation, as appears not only from the plentiful Fumes that manifestly fly off, but from the Reduction, which becomes impracticable without the adding anew what the Metals lost in Calcination; and notwithstanding the full Weight of the destroy'd Metal is not refunded: and this induc'd *Kunckel* to observe, not only the Weight, but the Bulk or Volume also; and he found that such calcin'd Bodies were increased in Weight, but diminished in Bulk. *Vid. Ejus Observ. Chym. P. II. c. 2. p. 32.*

4. Along with the Fire, other Things, as Sulphur, Mercury, Arsenic, Zinck, and the several Salts, are called in Aid.

5. But

5. But particularly Nitre ; and as it attacks with great Noise and Violence, and is lighted up into a Blaze with the inflammable Matter contained in Metals, Minerals, and other Things, the Operation is hence called Detonation.

6. Now this is sometimes performed in close Vessels, as in tubulated Retorts, furnish'd with proper large Receivers, to catch the Spirits and Flowers ascending in Detonation ; but for the most part in an open Vessel, as a Crucible : In the former Way the *Spiritus carminativus de tribus*, the *Tinctura nephritica Amalungiana* and other *Clyffi* are made : the latter Method is commonly used for the Preparations of diaphoretic Antimony ; tho' it be more adviseable to detonate in a tubulated Retort, whereby you obtain a good Proportion of Flowers, and a fine Clyffus of Antimony ; both which are otherwise lost.

7. In the Detonation in close Vessels of a moderate Size we are to observe the following Particulars : 1. Not to lute the Junctures too close, but leave an Air-vent for the displosive Spirits, when they come in too large a Quantity, to escape and expire a little, and not burst the Receiver : On which account, 2. The Matter you would deflagrate must be

be put in by little and little: And, 3. Some Water or Spirit of Wine poured into the Receiver, wherein the Vapours may settle.

8. The Calcination with other Salts, or even with Sulphur and Arsenic, is also oftner performed in close Vessels; after that the Matters to be calcin'd, especially Metals, are thinly laminated and granulated small, and then mix'd or stratify'd with the Salts, pound-ed Sulphur or Arsenic, and suffer'd to calcine for some Hours together in an earthen Crucible, with its proper Cover; and this we call Cementation.

9. And in particular this Operation is used for exalting or heightening the Colour of Gold, and purifying it from the ignobler Metals; and then call'd the Royal Cement.

10. Yet this Method may be very properly employed in calcining Copper with Sulphur, and in making the Vitriol of Copper, or in blanching Copper with Arsenic; for if you would put the Mixture in an open Crucible on the Fire, the Sulphur or Arsenic would quickly evaporate e'er the Metals were sufficiently penetrated.

11. The igniting of Salts apart in a moderate Fire, so as not to melt or run together, is also commonly called a Calcination; and
from

from the crackling Noise common Salt yields, Decrepitation. But Alum and Vitriol at first totally change to a Water, and boil a long time e'er the superfluous Moisture evaporates, and then the Alum heaves much, and becomes porous; but the Vitriol condenses very close, and must be pounded anew, if you would either distil or mix it with other Matters, and therefore it scarcely deserves the Name of a Calcination; an Appellation more applicable, when Vitriol in the Heat of the Sun or of a Stove is made to fall into a porous poudry Matter.

12. Yet such Appellations are not always so very accurately employ'd, seeing the hanging up in the Still-head, during Distillation, thin Slices of Hartshorn, in order to their being penetrated, softened, and made tender by the hot Steams, is also called a philosophical Calcination; or the boiling them in common Water till they become white and brittle.

13. Vitrification generally follows Calcination; for what in a moderate degree of Heat turns to a porous Powder or Calx, in a more vehement one runs together into a transparent Mass or glassy Body; yet always some Subjects more readily than others: *e. gr.* in the mineral Kingdom calcin'd Lead, Bismuth

Bismuth and Antimony easily melt to a Glass; Calx of Tin and *Crocus Martis* on the contrary more difficultly. The Ashes of Vegetables, but especially if mixed up with Sand or Flint, readily vitrify; and in this manner the common Glass is prepared: the Ashes of Animals on the contrary, or their calcin'd Horns and Bones, not without Addition of other fluxile Matters; and then they yield a Milk-colour'd and opaque Glass, almost like Porcelain. *Vid. Becher. Phys. subter. Sect. III. c. 3. §. 2.*

14. The most noted Instance of Vitrification in pharmaceutic Chemistry is the Glass of Antimony, which is best of all made of calcin'd Antimony, without any Addition; only regard must be had to the following Circumstances, if you would have it sufficiently transparent. 1. Calcine the Antimony well, and when it has cak'd together, again rub and grind it fine. 2. Suffer it to flow for a sufficient Space of Time, and when its Surface is transparent, try whether it be so within too; if not, let it run some time longer. 3. You are not to treat it much with Iron, or let the Coals fall into the Crucible, as thereby it might be reduc'd, and commence a Regulus.

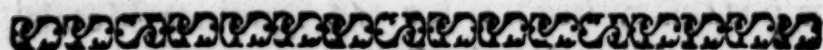
15. Cupelling is also a Species of Vitrification, wherein Lead vitrifies in a strong Heat, and retires into the porous Body of the Cupel or Test, at the same time vitrifying the other imperfect Metals added thereto, and carrying them along with it into the Cupel, while the Gold and Silver, which cannot thus be reduced to Glass, amass together and remain on the Cupel.

16. The Operation by the Cupel chiefly depends on the following Particulars. 1. The Cupel must consist of a porous and spongy Substance; and for this Purpose elixated Wood-ashes and some calcin'd Bone are commonly used. *Cardilucius* teaches how to make Cupels of Spar, and assures that they exceed those of Ashes, in that they require no long time to anneal or ignite under the Muffle. 2. You must give a sufficient degree of Fire, for the Lead to fume; or, as it is called, *drive*, and thus vitrify; yet the Fire must not be too strong, that the Lead may not carry off and destroy some of the good Metal. 3. You must give a proper Quantity of Lead, when you suspect the Gold or Silver to hold much Impurity; generally 16 Parts of Lead to one of the Metal which is in the Gold or Silver.

17. Cupel-

17. Cupellation is also sometimes performed on Assay-tests, and properly called Scorification; or in the large Way, on refining Hearths or Furnaces; whereon the Lead scorifies, and is forced off to the Sides, the Gold and Silver remaining in the middle of the Hearth; yet in this Way too the Metals still have some Alloy, and must therefore be cupelled or tested to their full degree of Fineness.

18. For further Information in these Matters, the Reader may consult *Modestinus Fachseus*, *Lazarus Ercker*; and among the Moderns, *Schindler*, and *Paræus's Probierebücher*; as also *Stahl's Anweisung Zur Metallurgie*, Elements of Metallurgy.



C H A P. VII.

Reduction and Revivification.

I. **R**eduction denotes the bringing any thing back to its former State and Consistence, and is properly understood of Metals calcined, vitrified, or otherwise destroyed,

stroyed, when by proper Additions they attain to their former Fusibility and Ductility.

2. Now this is done two ways; either by taking from, or adding something to the Subject. By the first way, the rapacious Salts or Sulphurs cleaving to the destroy'd Metals, are by proper Means either taken away or obtunded, that the pure Metal may after that fuse or run together; as for Instance, when *Aurum fulminans* is by Calcination along with Sulphur divested of its fulminating Quality, and then fused with Borax; or when, according to *Kunckel*, *Luna cornua* is calcin'd with Suet, or other fatty Matters, and fused along with common Salt.

3. By the second Method we add some essential Part or other to the Subject; and this is peculiarly needful for the ignobler Metals, as Iron, Tin, Lead, Copper, as also for Bismuth and Regulus of Antimony, as in Calcination and Vitrification they lose a Part of their Substance; wherefore they can never attain to their former metalline Consistence without the Restoration of what they lost.

4. From this it is easy to conclude, that bare alkali Salts alone are not sufficient in this Case, as some groundlessly imagine, but that we must along with these Salts call in Aid something

something that shall restore to the Metals their sulphureous Principle; and such is crude Tartar, and the black Flux-powder prepared therefrom; also Soot, Coals, Pitch, Soap, Suet, and other Fats. On this Principle Iron-filings may be employ'd in promoting the Reduction of easily fusible Matters, as the Glass of Antimony and Lead, also Lead calcin'd with Sulphur. *Vid. Stahl's Anweisung zur Metallurgie in der dabey befindlichen Einleitung zur grand-mixtion*, p. 109. seq. §. 16.

5. The Reduction of a larger Quantity is to be performed in a Tap-furnace; and here you stratify the Coals and calcin'd Metal or Ore alternately, and at last the melted Metal is tapp'd or drawn off below: at a Pinch, and when you have but a few Pounds to reduce, you may do it in a Crucible; and here you are to take not the same Weight, but the same Measure of Charcoal-dust, and half the Weight of Pot-ash, or other alkali Salt, as you have Matter to reduce; mixing them well together you put all by Ladle-fulls into a Crucible that is capacious, as the Matter is otherwise apt to heave and shed over: and thus you may easily reduce diaphoretic Antimony, Glass of Antimony, *Crocus Metallo-*

rum, Lead, Litharge, Minium, Glass of Lead, and the Lead imbib'd in Cupellation. This is one of the most curious Operations in all Chemistry, and a Skill in it not so easily acquired as one may be apt to imagine. As the Destruction, so also the Reduction of Metals is manifold; hence any one that would propose the Exaltation of Metals, must first attain to the ready Knack of reducing them, as on it a great deal depends in peculiar Processes of Alchemy.

6. Revivification is peculiarly applied to Mercury only, when we fix it either by means of Sulphur or the several corrosive acid Spirits, and take it out of its running Form, and deaden it as it were; afterwards separating these Matters therefrom by proper Additions, and restoring it to its former running State, we quicken or make it living.

7. But as the Ways of fixing Mercury and divesting it of its Fluidity may be different, so are the Means of recovering and reviving it different too; for Instance, Cinnabar and Æthiops mineral are best revived with Iron Filings, or pounded Regulus of Antimony; and the Regulus gives again a true Antimony, which is therefore called *Antimonium regeneratum*. Corrosive Mercury-sublimate and
Mer-

Mercurius dulcis can again easily recover their fluid Form, upon mixing them up with an equal Weight of Regulus of Antimony, or Iron Filings, and afterwards distilling from a Glass Retort; the former gives over a subtile Butter of Antimony, the latter a red Sublimate, which in the Air relents into a yellow fatty Liquor. The mineral Turbeth, the *Arcanum Corallinum*, and other Precipitates made with Aqua fortis or Spirit of Nitre, much sooner resuscitate than one would imagine, when one would edulcorate, as is commonly prescribed, with the Spirit of Whites of Eggs, Spirit of Tartar, or Spirit of Wine. Mercury precipitate *per se*, or that without any Addition fix'd by a long continu'd Sand-heat, and changed into a red Powder, again revives without any Addition, and re-assumes its former fluid, running State, to a little grey porous Powder only, upon committing it in a Retort to a naked Fire.

8. But it is observable that the fix'd Alkali's, and the pure urinous Spirits, and *Salia volatilia non oleosa*, are by far not so proper for reviving Mercury as the Matters just mention'd; for Cinnabar mixed up with equal Parts of volatile Salt of Hartshorn, and set to digest, is scarce in any wise changed thereby.

Mercury-sublimate rubb'd or ground with its Weight of volatile Salt of Hartshorn, and exposed to the Air, neither moistens nor revives, which yet befalls it in a small time, if but grossly ground and spread abroad on a Tin or Iron Plate.



Hints



Hints for Lutes, and for some peculiar Encheirefes.

- I. *A Lute for lining Iron Furnaces internally, as also for coating the Retorts to be used in Distillations in a naked Fire.*

IN this Case one must be directed by the Quality of the Clay one is supplied withal; if too fat, you must mix up with it a Third or Fourth of white Sand; but if a leaner Kind, it requires no such Addition, only suffering it to dry, in order to searce it, and separate it from the larger Stones; after which it is moistened with Herring-Brine, Bullocks Blood, or salt Water only, suffering it to soak thoroughly for a Night at least, and then working it up together; and with it you may line Iron Furnaces within-side, or coat Retorts to be exposed to a naked Fire.

To obviate the too many Cracks or Rents in the Lute as it dries, after searcing it in the manner mention'd, and e'er you moisten it,
mix

mix along with it some Hay or Hair, such as is used in Bolsters and Cushions, and then work it up with salt Water; it is however difficult to prevent them entirely, but when the Lute is dry run it over with your wet Hand, and close up the Rents.

The *Caput mortuum* of Aqua fortis, or some pounded Glass, Iron Scales, &c. mixed up with it, may be of some Service, but not absolutely necessary.

When Furnaces lined with such Luting are fully dry, and the Chaps closed up, you may run them over with a Paste made of powder'd Litharge and Water, such as Potters use in glazing, and which bakes or neals very smooth.

II. *Lute for the Junctures of Retorts and their Recipients in distilling in a naked Fire, as also for coating Bodies and other Glasses, when they are to be used in a strong Sand-heat.*

Take Brick-earth, let it dry well, in order for searcing, then mix some Straw therewith, and sprinkle it with common Water; let it stand for a Night at least, then work it up into a Paste, and it is fit for Use. The Coating for Glass Vessels should be no thicker than
the

the Back of a Knife, and when it chaps in drying, run it over with your moist Hand; when fully dry, do over both the Junctures and Coatings with a little Linseed-Oil; not too much, but here and there, as otherwise the Luting would become too hard, and compress the Vessels; the Oil penetrates into the Luting, and gives it an uncommon Firmness when afterwards exposed to the Fire; as *Becher's Experimentum Ferriferum* shews; whereby he teaches how to make a genuine Iron from Brick-earth and Linseed-Oil. *Vid. Becher Supplem. I. in Phys. Subterr. It. Miner. Aren. L. A. p. 854.*

III. *Luting for the Junctures and Cracks of Glasses.*

Take unslack'd Lime, grind it fine, and work it up with fresh or new Cheese into a thin Salve, with which spread a linen Rag or piece of Paper, which lap round the Junctures, or lay on the Cracks. Observe to make no more of it than you have immediate occasion for, as it turns hard in half an Hour's time. A Paste made of fresh pounded Lime along with Whites of Eggs, and spread on a linen Rag and laid on the Rents, holds very firm.

IV. *Another*

IV. Another Luting for the Rents and Cracks of Glass Vessels.

When a Glass Vessel has but a small Rent, after heating the Glass it often grows bigger, and spoils the whole Glass; to prevent which the preceding Lute is of Service; or rather the following when you treat any corrosive Spirit. Take Minium or Litharge, grind to a Powder, and make them up into a Salve with Linseed-Oil, with which to do over the Rents; it holds very well, but is long a drying.

V. An everlasting Lute, which is impenetrable.

First, make the following Varnish: Take Litharge and Minium, of each 12 Ounces; Mastic, Gum Sandarach, white Vitriol, of each half an Ounce; grind them fine, and boil with a Measure and a half of pure Linseed-Oil in a soft Fire into a proper Varnish; take well wash'd Clay and Minium equal Parts, Litharge half as much, pulverize and mix them: Of this mix'd Powder and the above Varnish take an equal Weight, and boil to a Mass, that may be thicken'd or thinn'd

thinn'd at Discretion, as you have occasion to use it in a stronger or weaker Fire; you need only press it hard on the Junctures, and it prevents the Escape of the most penetrative Spirits, and is always fit for Use; when too dry, only powder and boil it up with fresh Varnish.

VI. *Another Luting for the Junctures in distilling for urinous Spirits, or oleaginous ardent Spirits.*

Take Swine or even Bullock's Bladder, cut it into broad long Thongs or Slips, as is needful, which soak in luke-warm Water and clap wet round the Junctures, and tying them down with Thread, when dry they stick very fast, and shut very close: when the Distillation is over, applying a moist linnen Rag on the Piece of Bladder, it loosens, and comes off without tearing, so as to serve another time; yet at length the Bladder slips, becomes hard and brittle, and unfit for Use.

Further, we are to observe, that between the Junctures of the Heads and Cucurbits, as also of Retorts and Receivers, doubled Slips of Paper are to be laid or roll'd round, partly for the Glass to shut the tighter, and partly that the Receivers, when the Retorts happen
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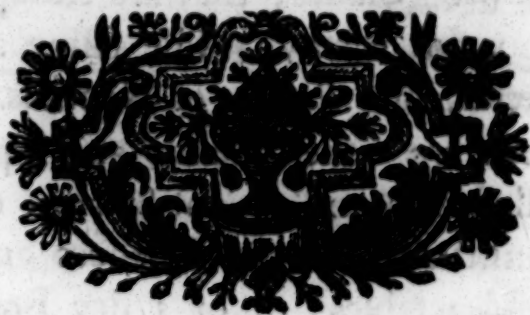
to be glowing hot, may not so readily burst; in which Case also lengthening Vessels may be put between the Retort and the Receiver.

VII. *The purifying of Aqua fortis by Precipitation.*

Aqua fortis, either as it is commonly sold, or as it comes over in the first Distillation, is unfit accurately to separate Gold and Silver, as it dissolves not the Silver entire, but lets some of it precipitate in form of a white Slime, which may remain in the Gold, and falsify the Assay; the Aqua fortis therefore must be first purified, or as it is called, precipitated, and that in the following manner: Put a little fine Silver-thread, or other pure Silver, nay, even Copper, into Aqua fortis, and let it dissolve in the Warmth as much as it can: Of this Solution pour into the Aqua fortis in question, and it becomes entirely milky and muddy, and is suffer'd to stand for a Day and Night, or till it settles; when clear, pour more of the preceding Solution to it, and if still milky and muddy, it is not yet fully purified; it is therefore set to stand again and settle, and again more of the Solution poured to it; and being no longer turbid, but continuing clear, it is good, and fit
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for the Depart; you may also without more ado filtrate it, which is the most expeditious way.

The white Slime, which in purifying Aqua fortis subsides to the Bottom, is only a Calx of Silver, which some hold for a *Luna cornua*, tho' neither so volatile nor so fusible, but approaching nearest to Silver-Calx, thrown down out of Aqua fortis with Spirit or Oil of Vitriol, and hence more easily reducible. *Vid. Stahl. Observ. Chym. Mens. Febr. p. 444.*





S E C T. II.

The Chemical Productions.

C H A P. I.

Alkali's both fix'd and volatile.

1. **T**HE chemical Productions may for the most part be reduced to the three following Classes; they are either saline, sulphureous, or earthy. The saline are Alkali's, Acids, and *Salsa*, or Neutrals. The sulphureous are either volatile and liquid, as the distilled Oils and ardent Spirits; or of a mean Consistence, as the Essences and Extracts of Vegetables; or of a dry Form, as Rosins, Flowers of Sulphur, Cinnabar. The earthy Productions are either totally fix'd, as diaphoretic Antimony, mineral Bezoar, *Antipepticum Poterii*, the various Crocus's of Iron; or semi-fix'd, as *Mercurius Vitæ*, Glass of Antimony, and most Magisteries prepared either by Solution or Precipitation.

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2. The saline Productions, as already mentioned, are best distinguished into three Species; the first includes the Alkali's, both the fix'd and volatile; to the second belong the Acids; the third Species constitutes the *Salsa*, or Neutrals, which are either of a liquid or dry Consistence, volatile or fix'd.

3. The Alkali's take their Name from a certain Plant growing on the Sea-coast, or in Parts abounding in Salt, and by the *Arabs* called *Kali*. This, with other Plants growing on the Sea-shore, is burnt to Ashes, and a Salt drawn therefrom, thence called the Salt of the Herb *Kali*, or with the Addition of the *Arabic* Article Alkali; and hence occasion has been taken of denominating the several lixivious Salts procurable from the Ashes of Vegetables, Alkali's. Now as all such Salts effervesce with Acids, and divest them of their Acidity, the Appellation has afterwards been extended further, and applied to urinous Spirits and Salts; nay, Lime, Chalk, burnt Hartshorn, and almost all earthy Subjects have been reduc'd to this Head; but as these last dissolve not in Water, and pass along therewith thro' the Filtre, which yet is a principal Requisite of a Salt, it is better to

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make a particular Class of them, and call them Antacids, not Alkali's.

4. In consideration of which we have only two Species of Alkali's, *viz.* fix'd and volatile; the former are the lixivious Salts, prepared by Incineration or Calcination; the latter are the urinous volatile Spirits and Salts. Among fix'd Alkali's, the best known and most in use, are, Salt of Tartar, fix'd Nitre, extemporaneous Salt of Tartar, Pot-ash, *Spanish Soda*; and in fine, the Salts procured from diuretic and sudorific Herbs, as Salt of Wormwood, *Carduus-benedictus*, Broom, Rest-harrow, Bean-stalks, &c.

5. Salt of Tartar greatly exceeds in Purity, Fusibility, and Pleasantness, common Pot-ash, or that alkali Salt elixated from common Wood-ashes in Iron Pans, and afterwards calcin'd in peculiar calcining Furnaces. It might formerly have been prepared from the Ashes of the Vine-cuttings, which also give a very sharp and white Salt, hence still call'd *Cineres clavellati*, and then one needed not scruple to set it on a Footing equal with, or to substitute it for Salt of Tartar; but as the *Cineres clavellati* are at this Day prepar'd and sold under the known Name of Pot-ash, they cannot be promiscuously used for Salt of Tar-
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tar in any particular medicinal or chemical Intention, which requires a pure Alkali; or at least the Pot-ash must be separated from its neutral Salt, either by Solution in cold Water, or by a spontaneous Deliquescence; as *Kunckel* rightly hints in his *Obs. Chym.* P. II. c. 10. p. 136. *seq.* Nay, for particular Processes, as the reducing Salt of Tartar to a volatile Salt or urinous Spirit, such is the fittest which has been drawn from the *Caput mortuum* of Spirit of Tartar, without any preceding Calcination, as being what is elixated from Tartar calcin'd to Whiteness; as *Ludovici de volatilisatione salis tartari* testifies from his own Experience.

6. The extemporaneous Salt of Tartar is prepared from equal Parts of Salt-petre and crude Tartar, pounded small together, and detonated in a glowing Crucible; but if to one Part of Nitre you take two of crude Tartar, grind them together, light them up and suffer them to burn out, you have no pure white Salt, but much of the coaly Substance of the Tartar remains therein, and hence commonly called the Black-flux, and most used for the Reduction of calcin'd Metals. The *Sal fixum* differs not much from the extemporaneous Salt of Tartar, only that

here, instead of Tartar, we take Charcoal-dust, *viz.* the Nitre is suffered to run in a Crucible, and on it in Flux are gradually laid Coals grossly beaten, till they no longer de-flagrate with the Nitre; after which it is still suffered to melt for a while, and then pour'd out into a heated Iron Mortar, where in cooling it turns of a greenish Cast; and of this a certain Chemist, *Christian Adolphus Balduin*, would make something extraordinary, and teaches how to extract a red Tincture with highly rectified Spirit of Wine, ennobled with the magnificent Title of a golden Tincture. *Vid. ejus Aurum Auræ, Lips. Anno 1675. 12mo.* but when exposed to the Air, it runs, like other Alkali's, into a fatty Liquor, called by some *Glauber's Alkahest*, but commonly *Liquor nitri fixi*, and affords an excellent Solvent for opening Amber, Myrrh, and sulphureous Subjects, when imbibed therewith, before Extraction with Spirit of Wine.

7. *Spanish Soda* differs from Salt of Tartar, fix'd Nitre, and the common lixivious Salts, in that it is somewhat saline, as being procured from Plants growing on the Sea-shore, and therefore comes nearest to the Alkali of the Ancients; besides it affords a much finer
and

and more lasting Glas than the Salts prepared from common Ashes, the Glas of which is perishable, and easily corroded by acid Menstruums, nay, even by the bare Action of the Air. *Vid. Stahl's Metallurgie in der dabey befindlichen einleitung zur grand-mixtion.* p. 318. §. 34.

8. The other fixed Salts from Plants are mostly employ'd in Medicine, as Diuretics and Sudorifics; and in this Intention *Mynsicht's Lixivium benedictum* is famous; yet some commend Salt of Fern for Glas-making, and the fixed Salt from Oak, or the Ashes only of the Bark or Spray of that Wood, for eating away the Skin without any extraordinary Pain.

9. As to the Effects of these Salts in the human Body, it is a great Dispute whether they retain the specific Virtues of their Simples. To decide herein, we must carefully weigh partly the Virtue of the Plants themselves, and partly the Manner of Preparation; for when the Virtue of a Plant principally consists in a volatile, strong-smelling or sharp-tasting Substance, this Substance is undoubtedly driven away by the Incineration or Burning; so that the fix'd Salts of cathartic Plants shall no longer purge, those of venomous

Plants hold no Poifon, and narcotic Simples be no longer poffeffed of a narcotic Quality: But as to the opening, attenuating, fudorific and diuretic Virtues of Herbs, thefe are fo far from being destroy'd, that by Incineration fuch Virtues are imparted to feveral Plants.

10. Further, if you gently calcine the Plants, and fuffer them foftly to glow on each other, the Salts procured therefrom acquire more of the Virtues of their Simples, than when they are calcined with a ftrong Fire, or with Sulphur; or when the elixated Salts, after the firft Coagulation, are ftill repeatedly calcined, diffolved, and again coagulated: tho' in the firft way they are fomewhat dark-colour'd, and not fo white, nay, are apter to run *per deliquium* than in the latter way, yet in medicinal Virtue they far exceed them: as *Borrichius* remarks in his *de Hermet. and vet. Ægypt. Sapient.* L. II. c. 5. §. 8. p. 353 and 370. and hence, p. 358, he advifes to calcine the Plants in clofe Veffels, and directly elixate them.

11. As to the Effect of fix'd alkali Salts in diffolving Sulphur, Antimony, Flints, and other Stones, as alfo in precipitating the feveral Solutions made by means of acid Menftruums, we have already made mention above;

bove; we shall here only hint at the twofold Change which fixed Salts undergo when cemented with Quick-lime, or when repeatedly run *per deliquium*, and again coagulated; as in the first way they acquire a greater degree of Acrimony, and in the latter an uncommon degree of Fusibility and Penetrancy.

12. *Van Helmont's* greatly crying up the fix'd Salts of Plants, when volatiliz'd, for medicinal Uses, and his setting the volatilised Salt of Tartar almost on a Footing equal with his *Alkabeft*, has given occasion to the Attempts made towards the volatilising fix'd Alkali's. Indeed *Van Helmont* himself in his *Treatise de Tribus Chymicorum principiis*, §. 84. gave some Light to the Matter, in regard he assures, that if an Alkali, as Salt of Cinnamon, be impregnated with its own distilled Oil, and digested for three Months, they together commence a volatile Salt, which shall have all the Effects that could be expected from the Simple. And in the same View is *Starkey's Corrector Vegetabilium*, wherein he impregnates Salt of Tartar with Oil of Turpentine, digests and rubs them together till they acquire a soapy Consistence, so as to dissolve in warm Water without the Separation of any Oiliness. *Ludovici* also *de Volatilisatione salis tartari*,

tartari, p. 48. assures, that he had imbib'd Salt of Tartar with its own empyreumatic Oil, put them together into a Retort, and set them only to stand for a Winter on a warm Furnace, when the Salt of Tartar was afterwards almost totally sublimed a volatile Salt; so that the Method of volatilising fix'd Salts with their own Oils, or other distilled Oils, is not without its Foundation; the only great Difficulty is, that fix'd Alkali's are so very backward to incorporate with distilled Oils: hence *Cassius* advises to saturate them first with Vinegar, whereby they more readily receive into themselves the distill'd Oils: but *Stabl* proposes the rubbing fine the alkali Salts whilst still warm, and only moistening them a little with such distilled Oils, and then letting them run *per deliquium*; and should any of the Oil poured thereto re-separate, it might be decanted off, the Salt gently crystallised be again impregnated and set to run; and thus in a few Weeks time one might procure what would otherwise take up many Months to accomplish. *Vid. Stabl's Anweisung zur Metallurgie in der dabey befindlichen einleitung zur grand-mixtion*, p. 323. §. 75.

13. Others,

13. Others, as the Author of the *Experimenta Lulliana*, and *Christopher Reinhard* in his *das licht der natur*, propose the Volatilisation of Salt of Tartar by means of a highly rectified Spirit of Wine; but tho' both the Spirit of Wine and the Salt of Tartar be considerably changed, the latter is still far from ascending in Distillation; as not only *Ludovici* in the above Treatise, but any one's own Experience may shew. Somewhat more probable is what others propose, *viz.* the saturating the fix'd Salts first with distill'd Vinegar, and then incorporating them with an urinous Spirit, and so volatilising them; tho' this Attempt may not be without its Difficulties too.

14. We incline not to dwell any longer on this Subject, but rather proceed to the Alkali's, which are naturally volatile: Of these the Spirit and volatile Salt of Urine are best known, and from them the other receive their Denomination, urinous; nay, they are often simply called volatile Salts, an Appellation held synonymous with volatile Alkali's: but there are also acid volatile Salts, as the volatile Salt of Amber, the Oil of Vitriol, and Spirit of Salt, when being distilled without putting Water into the Receiver, or in an excessive

cessive Cold, they appear in the Form of a dry Salt; and therefore it is better to specify them, by calling them volatile urinous Salts.

15. They are denominated Alkali's, as they, like the lixivious Salts or fix'd Alkali's, effervesce with Acids, obtund their Acrimony, precipitate what they dissolve, and along with them constitute a neutral Salt of a mean nature; but they are denominated volatile, partly as in Rectification they ascend before the Phlegm, and of themselves evaporate in the Air; partly as in combining with Acids, they yield not a Salt that endures the Fire, but only a mean Salt, which indeed rises not before the Phlegm, nor dissipates in the open Air, yet fumes away e'er its Ignition, or sublimes in close Vessels.

16. The best known and most used among these, are Spirit and volatile Salt of Urine, volatile Salt of Hartshorn, Vipers, Soot, the Spirit of Sal-ammoniac, both the simple and that prepared with Quick-lime.

17. An urinous Spirit and volatile Salt may indeed be drawn not only from Land Animals, but, as *Borrichius* from his own Experience testifies, from Fishes; as also from the several Parts of Animals, not only their
Urine

Urine and Horns, but also their Claws, Hair, Blood, Flesh, and even from Silk itself; but as they are either too nauseous, or their Virtues not sufficiently understood, we generally abide by the above-mention'd.

18. Spirit of Soot is from the Vegetable Kingdom, and therefore a clear Proof that Vegetables also are not to be excluded; but in order to yield a genuine urinous Spirit, they must be previously brought to Putrefaction, otherwise you have an acid or bitterish Spirit, like the Spirit of Tartar; but when they are sufficiently opened by Putrefaction, they all give forth an urinous Spirit, as *Wedelius* has explicitly shewn in his *duo Schediasmata de sale volatili plantarum*; and as appears from the dry'd Lees of Wine upon distilling by the Retort.

19. Some however are wont solicitously to distinguish between a Spirit and an urinous volatile Salt; but in this Distinction there is nothing farther, than that the Spirit is a volatile liquid Salt, and the volatile Salt a coagulated Spirit; and therefore the volatile Salt, when dissolv'd in its own Phlegm, may commence a Spirit; and the Spirit, when sublimed with a soft Heat in a Matrafs, may become a volatile Salt; yet this last Change
succeeds

fuceeds better with the Salts of the Animal Kingdom, than with those prepar'd from Vegetables. The same thing also holds as to Spirit of Urine *per se*, and much more does Spirit of Sal-ammoniac distilled with Potash, give forth a dry volatile Salt, than when made with Lime. As to these three Sorts, *viz.* Spirit of Urine *per se*, Spirit of Urine prepar'd from Sal-ammoniac with Pot-ash or Salt of Tartar, and the Spirit from Sal-ammoniac and Quick-lime, we are to observe the following things. 1. Spirit of Urine *per se*, if not abstracted from its Remainder after all the Phlegm is drawn off, changes not readily into a coagulated Spirit; but if either the whole be drawn off to Dryness, or the first true urinous Spirit running from the *Caput mortuum*, the Spirit separates from the Phlegm, and changes to a dry volatile Salt; the reason is, that as after the Phlegm, nay, e'er the empyreumatic Oil ascends, there appears a sharp acid Spirit, highly subtile and penetrative, which coming in Contact with the urinous Spirit, coagulates it, there thence resulting a volatile Salt, or a Species of a highly subtile Sal-ammoniac: without this Acid, when the Process is pure, and only the first Spirit taken which rises from the putrefied Urine before

before the Phlegm, the Spirit scarce, or not at all coagulates; an Observation but little regarded, and as little is the reason of the following Operation weigh'd. 2. When the Spirit of Urine is disengag'd from Sal-ammoniac by means of Potash or Salt of Tartar, there then plentifully ascends a volatile Salt; on the contrary, when disentangled by means of Quick-lime, there only rises a liquid Spirit, which is difficultly reduced to a dry volatile Salt; the reason is to be sought for in the difference of the Additions, Pot-ash being a Salt consisting of an Acid and an Earth, but quick-lime of a bare Earth only; when therefore Sal-ammoniac is added to Pot-ash or Salt of Tartar, the Acid of common Salt in the Sal Ammoniac rushes on the Earth of Salt of Tartar or Pot-ash, and strikes out the vegetable Acid, as what is more subtile, from its Earth. Now as also in Sal-ammoniac, after the Acid of Salt has seized on the vegetable Earth, the Spirit of Urine is set free and struck out, the subtile vegetable Acid and the Spirit of Urine ascend both together, absorb each other, and appear a dry volatile Salt; on the contrary, when Sal-ammoniac comes in contact to Quick-lime, the Acid of Salt seizes on the Earth of the Lime, and lets go the Spirit of

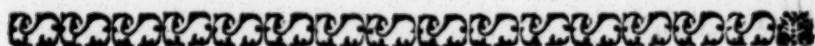
of Urine; and as the Lime holds little or no Acid, the Spirit of Urine ascends alone in a liquid Form, at least it absorbs not so much Acid as is necessary to its Coagulation; hence such a Spirit is difficultly reduced to a dry Salt.

20. This other difference between urinous Spirits, which are the Result of Putrefaction, or which are disengaged by means of Lime, Pot-ash, and other lixivious Salts, and those which are first forced off by a strong Fire, deserves our Regard; the former rise in Distillation before the Phlegm, but the latter come off first, after all the Phlegm is over, and the Still begins to glow; those are much purer, more agreeable and volatile; these on the contrary combin'd with much empyreumatic Oil, and therefore considerably fætid.

21. Yet they lay aside their fætid Odour in a good measure, and become also considerably purer and clearer, if first their empyreumatic Oil be parted from them as much as possible by the Separating-glass, and afterwards they be rectified a number of times in *Balneo* on Pot-ash, or their own *Caput mortuum*, which has first been calcin'd to Whiteness. In this manner may Spirit of Hartshorn and Soot, both which are very nauseous,
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be made as clear and pure as a Spirit of Sal Ammoniac.

22. We are also to observe, that the urinous Spirits, well rectified and dephlegmated with a highly rectified Spirit of Wine, coagulate together; in particular, Spirit of Harts-horn and Spirit of Sal Ammoniac made with Pot-ash does this very readily, but not so with the urinous Spirit from Wine-lees, or with Spirit of Sal-ammoniac prepar'd with Quick-lime: But when such a Coagulum from an urinous Spirit and Spirit of Wine is exposed to the Warmth, or drawn off *in Balneo* by the Alembic, it becomes fluid; and such an urinous Spirit incorporated with Spirit of Wine dissolves distilled Oils, which before it would not do: and on this Principle the *Salsa volatila oleosa* are prepared; and in this View therefore you may without more ado, either in the first distilling of the Spirit of Sal Ammoniac with Pot-ash, add to it the Spirit of Wine, or you may take the Spirit of Sal Ammoniac or of Urine, which has been made with Lime; for such coagulates not with Spirit of Wine, and yet when previously incorporated with Spirit of Wine, it dissolves distill'd Oils as readily, nay, more so.



C H A P. II.

Acids.

I. **A** C I D S are generally derived from the Mineral and Vegetable Kingdoms; for tho' *Vieussens* has in a peculiar Dissertation attempted to maintain that the fix'd Salt of the Blood yields an acid Spirit, and that the like was procurable from the fix'd Salt of Urine, it is rather Matter of Curiosity than a thing really useful and practicable. From the Animal Kingdom we draw an acid Spirit in the following manner: We softly distil a Quantity of Urine till all the urinous Spirit and Phlegm come over; at last, when all is near dry, and this must be well heeded, there ascends e'er the thick Oil comes over, a penetrative acid Spirit, yet in no great Proportion; this volatile animal Acid holds some oleaginous Parts, and hence it comes to burn like a Spirit of Wine, yet with a Flame somewhat more subtile, especially that Spirit prepared from the fæcal Matter. *M. Pott* in his *Dissertatio de Sulphuribus Metallorum*

Metallorum makes an Arcanum of it, and ascribes peculiar Effects thereto, tho' he does not expressly name such Menstruum. From fix'd Salt of Urine an acid Spirit is thus drawn in a large Quantity, *viz.* put one Part of Oil of Vitriol to two of Salt of Urine, or an equal Weight of calcin'd Vitriol, and distil; there ascends a penetrative, fiery, acid Spirit, like a Spirit of common Salt, and the Oil of Vitriol lays hold on the Earth of the Salt, and makes of it a *Sal mirabile*.

2. The Acids from the Mineral Kingdom may properly be divided into three Classes. The first contains the sulphureous vitriolic Acid, *i. e.* Spirit and Oil of Vitriol, Spirit of Alum, Spirit and Oil of Sulphur *per campanam*, and the *Spiritus aperitivus Penoti*. The second includes the nitrous Acid, as the Spirit of Nitre, *Hoffman's* smoaking Spirit, Aqua fortis, Aqua regia, bezoardic Spirit of Nitre, Clyffus of Antimony. In the third Class we reckon the Acid of common Salt, *viz.* the common Spirit of Salt, the philosophical Spirit of Vitriol; and even the Butter of Antimony.

3. Vitriol and Sulphur are indeed as to external Appearance considerably different, but in their Original they have the nearest Affi-

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nity possible; for if you sublime in close Vessels a sulphureous or vitriolic Pyrites, directly as it comes out of the Earth, it gives forth a good deal of an inflammable Sulphur, and no Vitriol; but exposed for some time to the Air, it spontaneously relents, and afterwards elixated with Water, yields much Vitriol, with scarce any Trace of an inflammable Sulphur; and thus the Acid of Sulphur and of Vitriol differ not essentially, only that this last may also be set free in close Vessels by means of a strong Heat, which succeeds not with the Acid of Sulphur; for Sulphur by a strong Heat ascends in close Vessels unsever'd, in its entire Substance, and consequently its Acid must be disengag'd by Deflagration in the open Air, wherein the ascending acid Fumes are intercepted by means of a glass Bell, whence the Denomination of Spirit and Oil of Sulphur *per campanam*. It is certain the Acid acquires in the Deflagration from the inflammable Substance, with which it is entangled, a considerable Alteration and a degree of Volatility, as is easily perceivable from the penetrating Smell; yet in the Spirit or Oil of Sulphur *per campanam* little of it is observable; for what has conceiv'd any Alteration from the inflammable Substance, is so volatile

volatile as even to ascend before the Phlegm, wherefore it evaporates and is quite lost.

4. The best Method for obtaining or catching such a volatile Spirit of Sulphur, is by means of a fix'd Alkali; and if the Sulphur burns softly and leisurely, it also yields more volatile Spirit; you may therefore fill a flat earthen Dish or Bowl with pounded Sulphur, set a Match in the middle, and light it up; let it burn softly and fume, hanging over the burning Sulphur linen Cloths moisten'd with a strong Lye of Pot-ash: now after the Cloths are well impregnated with the Sulphur-fumes, the Salt is again elixated out of them and gently boiled; and you procure a peculiar neutral Salt, composed of fix'd Alkali and the volatiliz'd Acid of Sulphur. Upon pouring on this Salt an equal Quantity, or two Thirds of Oil of Vitriol, and distilling by the Retort, the fix'd Alkali rushes on the Acid of Vitriol, and lets go the volatile Acid of Sulphur, which comes over in form of a very penetrative Spirit, yet in no great degree acid. *Vid. Stahl's Anweisung zur Metallurgie in der dabey befindlichen einleitung zur grand mixtion, p. 350. §. 41.*

5. A like sulphureous Spirit may be drawn from Vitriol, upon distilling it in an earthen Retort that has some fine Rents at bottom, or in Iron Vessels; but this is no peculiar Spirit, only a changing of the fix'd acid Spirit which is in Vitriol, by means of the phlegmatic Particles, or those constituting Flame; as the more fixed Acid, already separated, namely, the Oil of Vitriol, acquires a highly penetrative sulphureous Smell when cohobated with Spirit of Wine, or drawn off from running Mercury.

6. But the following Method is the best for disengaging the Acid of Vitriol; the Vitriol is suffer'd to crumble into a spongy Powder in a warm Stove, or in the Sun; but if you first dissolve and purify it in Water, or precipitate with Iron Filings or granulated Zink, the metallic astringent Earth, it is so much the better. Now the Vitriol thus reduced to a Powder, fill therewith two Thirds of a coated earthen Retort, and commit it to a Furnace, where it may have a Fire of Suppression; at first a gentle Fire is administered, till the first and most subtile Spirits, which greatly heat and easily burst the Receiver, together with the Phlegm, come over; after which the Fire is heighten'd, till the Receiver

ver is fill'd with white Fumes; and the same degree of Heat is to be kept up for two, three, or four Days, till no more white Fumes or Clouds appear; and at last the Fire is raised to the greatest Pitch, or to a pure Flame: the Spirit brought over is poured all of it into a Cucurbit, which is set *in Balneo*; and first the subtile Spirit, which comes over in small Drops, is drawn off, and then the Phlegm too; and this is continued so long as any thing will come over *in Balneo*; and there remains behind in the Cucurbit a dark colour'd, acid, ponderous, and thick Liquor, which on account of its Consistence is commonly call'd Oil of Vitriol; but if the Rectification be performed from a Retort in Sand, after the Phlegm much white Fumes and acid Drops come over, generally called Spirit of Vitriol; but by the first Method *in Balneo* the whole of the Spirit by a careful Dephlegmation becomes an Oil, which also at last may be forced over with a strong Fire; and by Rectification it becomes totally clear and bright, but is again easily tinged by the least Bit of Wood, Straw, Rosin, and the like.

7. Alum greatly resembles Vitriol, the difference consisting only in this, that Vitriol has for its Basis a metallic, and generally a

martial or cupreous Earth, but Alum a calcareous or chalky sort; yet the separated Acid of Alum, or its Spirit, is not so much used as Alum in Substance, particularly when by due Calcination it is first set free from its superfluous Phlegm, and then it may be commodiously employ'd in disengaging the Acid of Nitre and common Salt from their alkaline Earths.

8. The *Spiritus aperitivus Penoti* is no other than a Spirit of Vitriol, somewhat alter'd by the Addition of calcin'd Tartar and Flints, so as not to be very sharp and acid; nay, if in Distillation the Fire be too weak, there only comes over an insipid Phlegm; which yet properly belongs to this first Class.

9. We now proceed to the second Class, which contains the nitrous Acid, much more volatile than the vitriolic; but as in the Mixture of Salt-petre it is entangled with an alkali Salt, it suffers not itself to be separated therefrom by Fire alone; and therefore we commonly use Bole, Sealed-Earth, or that common Clay only which burns red in the Fire, and then mixing and working up the Salt-petre therewith, we distil the Mixture from a coated earthen Retort with a strong Fire;

Fire; and in this manner is common Spirit of Nitre prepared.

10. The usual Reason assign'd why Nitre requires such Additions to make it give forth its Spirit, is, that in a strong Heat it is apt to run together, and so not let go its Spirit; and consequently its Parts must be discontinu'd or sever'd from each other by something that may prevent its Fusion, that the Fire may have the greater Effect on it, and force out its Spirit; yet this agrees not with Experience, for at that rate Glass beaten small or Sand might have the same Effect; nay, the Earth, which was once used, if first elixated, might serve still quite as well as at the beginning; neither of which we find answer: and therefore there must be another Reason for it; to establish which will be no difficult Matter, when we consider that the nitrous Acid may be disentangled from its alkaline Earth still more easily by means of Vitriol or calcin'd Alum, and readiest of all by means of Oil of Vitriol.

11. The vitriolic Acid is much more ponderous, or as we commonly speak, much more strong than the nitrous Acid and the Acid of common Salt; and therefore when it lays hold on the alkaline Portion of these Salts, both the nitrous Acid and that of

common Salt, as being more light and volatile, must cede, and thus be set free from their alkaline Earth. Now the more pure and free the Acid of Vitriol itself is, the better also it may promote the disengaging the nitrous Acid and that of common Salt. Oil of Vitriol therefore is in this respect preferable to all other, as it is disengaged from its metallic Earth and all superfluous Phlegm; next to it is burnt Alum, and then Vitriol calcin'd to Whiteness; the weakest are Bole and Clay, which indeed is a vitriolic Earth, as appears from the red Colour it acquires in burning, yet the vitriolic Acid is very sparingly therein; and therefore the Proportion of three Parts to one of Salt-petre is too little, there remaining after Distillation a good deal of Nitre unalter'd, which may be again elixated, and set to distil with fresh Bole, and it yields a Spirit as before, and this even to a third time.

12. Aqua fortis is no other than a Spirit of Nitre, which is usually distilled in earthen Retorts or Iron Bodies with Vitriol calcined to Whiteness; and such are under a Mistake as imagine this Distinction to be between Spirit of Nitre distilled with Bole and Aqua fortis, *viz.* that the former is not only harmless, but also a wholesome Medicine, and the

the latter a noxious, corrosive, and deadly Poison; as there is no other Distinction than that drawn from the above Manner of Preparation; and that Spirit of Nitre with Bole or Clay is less subtile and volatile than that distilled with Vitriol, as that prepared with Alum still exceeds this; and that with Oil of Vitriol, all of them, in Penetrancy and Strength; and this is the Foundation of *Hoffman's* smoaking Spirit.

13. Aqua Regia is nothing else but Aqua fortis, or Spirit of Nitre, strengthened or heightened with some of the Acid of common Salt, so as now to dissolve Gold, which before it could not do; and therefore it is all one whether you pour Spirit of Salt distilled apart on the Aqua fortis, or whether you dissolve therein common Salt itself, or Sal Ammoniac, and afterwards draw them off together, or whether without distilling you only dissolve the Salt therein; for if you only propose a slight Solution of Gold, there is no such great Odds between these several Preparations. Of like nature is the bezoardic Spirit of Nitre, which is Spirit of Nitre drawn off in the Preparation of mineral Bezoar from the Butter of Antimony; for from the Butter of Antimony, the Acid of common Salt which
was

was in the Butter, comes over; and thus of a Spirit of Nitre is made an Aqua Regia.

14. Yet Spirit of Nitre alone, when abstracted a number of times from fresh Nitre, may, as *Cramerus* hints in his *Collegium Physicum*, dissolve Gold; nay, Spirit of Nitre distilled with burnt Alum has the same Effect, if only so much Nitre be dissolved therein as it can dissolve cold. Spirit of Nitre also dissolves Gold, if in distilling, particularly with Oil of Vitriol, a highly rectified Spirit of Wine be put into the Receiver. In this Solution, upon distilling off the Spirit, we find that the Gold, e'er it is dry, falls down a massive Body; and this is to be ascribed to the inflammable Part with which the Spirit of Nitre is charged by the Spirit of Wine, as being the sole Cause of the Reduction; as Gold also precipitates in a massive Form out of Aqua Regia, or is rather reduced upon pouring in an Oil of Turpentine.

15. *Basil Valentine* teaches how to distil a peculiar Aqua Regia from Nitre with Sal Ammoniac, and which he calls the *Fechterbad*, *Aqua Pugilum*; but as Nitre deflagrates almost as violently with Sal-Ammoniac as with Sulphur, there is Danger in the Preparation, or it must be gone about with great Heed-

Heedfulness in a tubulated Retort; which is also the best Manner of making the Clyffus of Antimony or Sulphur with Nitre.

16. *Kunckel* in his *Observationes Chymicæ* gives another Method of distilling a very volatile Spirit of Nitre with Arsenic; and it has in particular this Advantage, that upon putting it into a dry Glass, and closing it up tight, it will for upwards of a Year together retain the deepest red Colour, and neither coagulate nor alter its Colour; yet a certain Author complains that this Mixture of Arsenic and Nitre does in Distillation take fire and burst every thing to pieces.

17. But we proceed to consider the Acid of common Salt; and this is the weakest of all, and must on this Score yield to the nitrous Acid, as this last does to the vitriolic; for upon pouring a Spirit of Nitre on common Salt, and distilling it therefrom, a Spirit of Salt rather than a Spirit of Nitre comes over, a genuine inflammable Nitre remaining behind; then pouring Oil of Vitriol thereon, the Spirit of Nitre comes over first; but otherwise the Acid of common Salt is commonly disentangled with Bole, Sealed-Earth, or common Clay; but better with burnt Alum, and best of all with Oil of Vitriol:

triol: the reason has been assigned above, when we treated of the nitrous Acid; for in this respect there is an Affinity between the nitrous Acid and that of common Salt.

18. Yet we may also, without any Addition, distil from common Salt a subtile Spirit, as *Lemery* relates of *M. Seignette*, an Apothecary at *Rochelle*, nay, as I have learned from my own Experience, and generally at the same time you procure some Sublimate, entirely resembling a Sal-ammoniac; but for this Purpose the best Salt is that boiled last of all from the Brine, which neither shoots, nor scarce becomes dry; and it is worth observing, that upon exposing again the *Residuum* only to the Air, it becomes damp, and gives forth more Spirit; and this may be repeated as often as you will. In like manner may a Spirit be distilled from Nitre without Addition, by dissolving the Nitre in Water, and suffering a Part of the Nitre to shoot, till there remain an oleaginous Liquor, which when distilled yields also a Spirit, like Brine of Salt.

19. The philosophical Spirit of Vitriol is reducible also to this Class, tho' its Name would seem to give it a Place in the first; for it is no other than the Water, where-
with

with the Butter of Antimony is thrown down and edulcorated, in making *Mercurius Vitæ*: but that the Acid which is in the Butter of Antimony, properly proceeds from the common Salt, appears hence; because Spirit of Nitre, as was said above, commences thereby an Aqua Regia: as otherwise some give this philosophical Spirit of Vitriol pretty strong even internally, for allaying febrile Heat; yet it were better for that Purpose to rectify it once more, than only separate it by Filtration from the *Mercurius Vitæ*; tho' it were still better to lay it quite aside, and substitute for it a Spirit of Vitriol, or Clyffus of Antimony.

20. To conclude; we shall only mention the Remarks *Becher* makes on the Properties of these three Species of Acids, *viz.* The vitriolic Acid has the Power of fixing; the nitrous, that of tinging; the Acid of common Salt, that of volatilising and mercurifying; as in the first, the binding Earth predominates, and is dissolv'd and carried over by the Acid; in the second, the inflammable Earth; and in the third, the mercurifying sort.

21. Sometimes these mineral Acids are also mixed along with Spirit of Wine, whereby they are sensibly deprived of their Acidity,
and

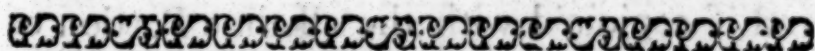
and taste quite pleasant and mild, and are therefore call'd dulcified acid Spirits; nay, after this they incorporate with Alkali's both fix'd and volatile, almost without any Struggle or Effervescence; whence it is easy to imagine that they are considerably alter'd in their Virtues; only that it is not hitherto sufficiently known what new Virtues either for chemical or medicinal Purposes they acquire. The dulcified Spirit of Salt is commonly cry'd up for extracting the Sulphur out of Gold, and making it into an *Aurum Potabile*. Dulcified Spirit of Nitre is commended as a noble Anti-colic, nay, an universal Antispastic and Paragoric; but Experience must first decide in this Matter. When we reflect on this new Mixtion of these dulcified Spirits, which is manifest from the reason of their Disengagement, we may *à priori* conclude this or the other thing about their Virtues, both as to chemical and medical Uses, and which also may coincide with practical Observations *à posteriori*; and then we must examine what the Mixtion of Spirit of Wine is, and also what the component Parts of the acid Spirit we would mix therewith. Spirit of Wine is composed of a highly volatile vegetable Acid and a highly subtile inflammable Earth; but
Oil

Oil or Spirit of Vitriol, for Instance, consists of the primogenial Acid and the fixing Earth of the first Kind, closely combin'd together. Now when the Oil of Vitriol comes in contact with Spirit of Wine, its Acid rushes against the inflammable Earth of the Spirit, and sets it free from the volatile vegetable Acid; which thus freed, ascends, and comes over with the volatile Acid of the Oil of Vitriol; but the more gross inflammable Earth, which held this vegetable Acid, is destroyed by the mineral Acid, or rather absorbed into the fixing Earth, and thereby fixed. Now this subtile Acid of Spirit of Wine has gain'd from the Oil of Vitriol a subtile Portion of a binding Earth, which is the volatile Part of the Oil of Vitriol, whereby it gently astringes and corroborates the solid Parts, so as again to recover them to their former Tone. The same thing also holds as to both the other Acids of Nitre and common Salt; that disengag'd by Spirit of Nitre, combines with the volatile Part of the Spirit of Nitre, which is an acido-sulphureous Matter; just as the volatile Part from Oil of Vitriol, associated to the Acid of Wine, is an acid-earthy Matter, endowed with a fixing Quality. On this Footing is the Acid from Nitre, in respect of the
evaporated

evaporated Sulphur, an Anodyne and Antispasmodic; nay, not without reason deem'd an universal Paragoric, when well prepar'd. But the Acid of Wine prepar'd with, or disengag'd by Spirit of Salt, and to which the volatile Part of the Spirit of Salt associates, has gain'd a resolving Virtue; and hence it commences an universal Aperient and Resolvent, not to be despised in Medicine when carefully prepared from the Spirit, disengaged with Oil of Vitriol, or rather Oil of Salt, in a due Proportion. We must here mention, that these dulcified Spirits require great Accuracy in the Preparation; and this we are not to expect from a common Chemist, but from one who understands the Mixtions of Bodies, and how to proportion the Degrees of Fire and the Quantities to the Mixtion; and on this Footing such a Person will be capable of applying these Spirits to chemical Uses; as we have already hinted, that that from Spirit of Nitre has an Ingress into Gold: but these Matters relate to higher Speculations.

22. The most usual Acids from the Vegetable Kingdom are, distilled Wine-Vinegar, Spirit of Honey, Spirit of Oak, Guaiac, and other the like hard Woods; and they are for the most part employed in dissolving Pearls
and

and Corals, and extracting a Tincture from Glass of Antimony; they also dissolve some Metals, as Iron, Copper, and calcin'd Lead, yet very sparingly: and among all the known Preparations, there is none but Sugar of Lead, Crystals of Verdigrease, and in fine, *Beguinus's* and *Hartmannus's* green Precipitate, which are dissolv'd and extracted with distilled Vinegar.



C H A P. III.

Of the Salsa, or neutral Salts.

1. **F**ROM the Combination of Acids and Alkali's result neutral Salts; and as both the several Acids and Alkali's differ in their Natures, we may easily imagine there will be different Species of Neutrals.

2. But we shall only consider the following threefold Distinction; either they are fix'd or volatile, solid or liquid, fully saturated or exceeding either in the alkaline or acid Part.

3. It would cause too great a Variety to distinguish them according to the various Species of Acids and Alkali's; for Instance, from

the nitrous Acid and a fix'd Alkali combin'd there arises a *nitrum regeneratum*; the Acid of common Salt and a fix'd Alkali yield the *Sal digestivum Sylvii*; the *vitriolico*-sulphureous Acid combin'd with a fix'd Alkali from Tartar or Pot-ash, produces the *Tartarus vitriolatus*; but if combin'd with the alkaline Portion of Nitre, the *Arcanum duplicatum*, the *Nitrum sulphuratum*, or *Sal polychrestum Glasseri*, as also the *Nitrum Antimoniatum*; and if conjoin'd with the alkaline Portion of common Salt, we obtain *Glauber's Sal mirabile*.

4. From a fix'd Alkali and distilled Vinegar we procure the *Arcanum tartari*, or the *Terra foliata tartari*; but crude Tartar, saturated with its own or other fix'd Alkali, yields the *Tartarus tartarificatus*: Take the volatile Alkali's, or urinous Spirits, wherewith to change the Acidity of crude Tartar, and you have a soluble Tartar.

5. In other Respects, urinous Spirits combin'd with any Acid whatever, give a *Sal Ammoniac*; among which, that from Spirit of Salt and Spirit of Urine comes nighest the common sort; the Salt from Spirit of Nitre and an urinous Spirit shoots into oblong Crystals like Nitre, but suffers itself to be totally sublimed; the Salt compounded from Oil of
Vitriol

Vitriol and Spirit of Urine is *Glauber's Sal ammoniacum secretum*, on which he has writ a whole Treatise.

6. Distilled Vinegar, saturated with an urinous volatile Spirit or Salt, gives no dry Sal-ammoniac, but an oleaginous Liquor, which ascends next after the Phlegm, and comes over in fatty Veins, and which therefore may not improperly be called a liquid Sal-ammoniac; and to this Head belongs also the Liquor *C. C. Succinatus*, which others, tho' mistakenly, reckon among the nitrous; since it is only such a liquid Sal-ammoniac, arising from the Combination of the volatile Salt of Amber, as an Acid, with the volatile Salt of Hartshorn, as an urinous Salt.

7. If according to the above threefold Distinction we reduce the Neutrals to certain Classes; to the fix'd Neutrals we may reckon the *Tartarus vitriolatus*, the *Arcanum duplicatum*, *Glauber's Sal mirabile*, &c. The volatile Neutrals are, *Glauber's Sal ammoniacum secretum*, the *Liquor C. C. Succinatus*; this indeed a liquid, that a solid Salt. Crude Tartar is a Neutral, wherein notwithstanding the Acid prevails; but mix'd with an equal Weight or equal Parts of a fix'd Alkali, we have a Neutral, wherein for the most part the Alkali

predominates ; and such is the *Tartarus tartarizatus*.

8. We are further to remark of the Neutrals, that some of them are again easily decomposed ; for Example, the *Nitrum regeneratum*, the *Sal digestivum Sylvii*, Salt of Tartar saturated with distilled Vinegar, or the *Terra foliata tartari*, all by means of Oil of Vitriol ; the ammoniacal Salts, by means of Salt of Tartar, and any one Alkali ; but others again, particularly those combin'd of the vitriolic Acid and a fix'd Alkali, have such a firm Mixtion, as to be decomposed by no Force of Fire, nor even by any other Acid or Alkali, but only by the Addition of a subtile Fat or inflammable Matter ; for then the Acid, along with the inflammable Substance, commences a genuine Sulphur, and the Alkali is again set at liberty. *Vid. Stahl. Zymotech. p. 117, 119. It. ejusd. Observ. Chym. Mens. Jul. as also his Anleitung zur Metallurgie, &c. p. 403. §. 32.*

9. Before we conclude this Subject of Neutrals, we must subjoin something on the vitriolic Neutrals ; some call them acid Salts, as in distilling they give forth an acid Spirit ; but it were better to class them next to the Neutrals ; for as from the Combination of
Acids

Acids and Alkali's the neutral Salts arise, so from the Conjunction of an acid with a metallic Earth, a Vitriol.

10. The best known and most in use among these Salts, are the Vitriol of Iron and Copper, the Crystals of Verdigrease, green Mercury precipitate, *Mynsichtus's Sal Jovis*, Sugar of Lead, the lunar Crystals, or *Lapis infernalis argenteus*; as also the several Tinctures, or rather Solutions, both solar and martial; for Instance, the *Tinctura martis cum succo pomorum Borsdorff*. *Cum succo cydon. Wedelii belleborata*, & *Ludovici tartarifata*. And it would be no Impropriety to reckon here Tartar emetic, emetic Infusions made with Wine, or even mineral Turbeth, Mercury precipitate and sublimate.



C H A P. IV.

The sulphureous Productions.

1. **T**HE sulphureous Productions are, as we mention'd above, threefold, viz. either liquid or volatile, as the distilled Oils and ardent Spirits; or of a mean Consistence,

sistence, as the Essences and Extracts of Vegetables, and most of the expressed Oils; or of a dry and solid Form, as the Flowers of Sulphur and Benjamin, the Rosins of Scammony, Jalap, Gum-gutta, and Cinnabar.

2. The distilled Oils are either æthereal or empyreumatic; the æthereal Oils come over before or along with the Water, but the empyreumatic all together at last, after all the Phlegm is brought over; the former retain the Smell and Flavour, and doubtless also the Virtues of their Simples; but the latter acquire a great degree of Nauseousness, even tho' distilled from the most fragrant Subjects, as are Roses and Violets; and tho' by Rectification *in Balneo* a Part as subtile and volatile, nay, even as clear and sparkling as the æthereal, may be procur'd, yet they still want of their best Property, their agreeable Odour; the former Oils can only be procured from some Vegetables, and that in a small Quantity; but the latter from almost all animal and vegetable Subjects, and in a considerable Quantity.

3. Among the Simples, which yield these æthereal Oils, the Turpentine-Tree holds almost the first Rank; next come the Cones and Sprigs of the Firr, with the Berries of
Juniper,

Juniper, all which yield a considerable Quantity thereof; whence they are often used to increase, or rather adulterate the æthereal Oils of such Plants as yield but a little: but this Cheat is discover'd several ways; for Instance, the genuine distilled Oils from Plants, and most aromatic Drugs, dissolve in an alkalisate Spirit of Wine, which the sophisticated never do. The distilled Oils adulterated with Oil of Turpentine, erase or discharge the Writing on the Paper, wherewith the Glass, in which they are kept, is ty'd up, but not so the genuine: and in fine, when such adulterated distill'd Oils have stood for a long time, they turn clammy, and their Turpentine Odour becomes more and more sensible.

4. Besides the Matters above-mention'd, all odoriferous Seeds, as Fennel, Anise, Cummin, &c. nay, even their Stalks, and most aromatic Drugs, as Cinnamon, Cloves, Nutmeg and Mace, also some Woods and Roots, as Sassafras, Red-wood, Angelica, &c. yield much æthereal Oil; whereas most Herbs, as Baulm, Mint, Thyme, Marjoram, but especially the odoriferous Flowers, as of Roses, Rosemary, Pomgranates, Jessamin and Citrons, afford very little; so that formerly at *Florence* a whole hundred Weight

of fresh Roses was distilled, and scarce an Ounce of Oil procured.

5. From the odoriferous distilled æthereal Oils, by Addition of the expressed Oil of Nutmeg, or with blanch'd Wax, all manner of Balsams are made; they also dissolve in an alkalifate ardent Spirit, and then they are called liquid Balsams, which *Glauber* teaches how to re-coagulate by means of their own fixed Salt dissolved in their own Water, and bring them to a soapy Consistence, shewing how they may be used instead of the common Balsams, which are too greasy.

6. The empyreumatic Oils are only used externally in Contusions of the nervous and tendinous Parts, and in Tumours of the Glands, in which Cases they are strong Resolvents and Discutients; as *Wedelius's Balsamus vulnerarius* is only the fætid Oil of Tartar mixed up with one or two Parts of Balsam of *Peru*: to give them internally is not so adviseable, as they cause too great a Commotion in the Blood, a Drop or two being capable of moving the whole Mass.

7. The ardent Spirits hold the first Rank, and indeed arise from the same Particles, which, without a preceding Fermentation, would become a distilled æthereal or empyreumatic

reumatic Oil: but as these Spirits produc'd by Fermentation may be a-new impregnated with the Smell and Taste of other Simples, they then acquire new Denominations, not from the first Subject, from which by Fermentation they were prepar'd, but from those by which they are now speciflicated; yet with this Distinction, that the former are called ardent Spirits prepared by Fermentation, but the latter abstracted Spirits.

8. Nay, we might still add a third Species, *viz.* when one or more Simples are put in during the Fermentation, from which the Spirit afterwards borrows its Flavour and Smell, and its Name too, tho' its proper Body be from some other Subject: For Instance, when Sugar is dissolved in Water, and this Solution poured on fresh Roses; or if new Beer, especially that of Wheat, be poured on Elder-flowers, and they be afterwards suffer'd to ferment together, with the Addition of some fresh Yest, and an ardent Spirit be distilled therefrom, the Spirit will smell and taste strong of Roses and Elder-flowers, and may therefore be called a Spirit of Roses or Elder-flowers; tho' properly speaking it be produced from the Sugar or new Beer by means of Fermentation, which might therefore
be

be called a Confermentation ; a Method greatly adapted to such Simples as of themselves yield but little Spirit, such as are the most Herbs and Flowers.

9. On the contrary, the Seeds and sweet Juices of Vegetables give forth a much larger Proportion of ardent Spirits ; for Instance, Juniper - berries, Elder - berries, Raspberries, Apples and Pears, Sugar, Honey, and Must, but in particular Rye, Wheat, and Barley ; Peas also yield a good deal, but an unpleasant Spirit ; whereas that from Oats is very pleasant, but in small Quantity ; as *Ludovici* testifies from his own Experience, in his *Annotiones* subjoined to his *Pharmacia* ; and he computes, that as a *Weimar* Bushel of Rye gave 90 lb. of Spirits, one of Barley, 65 lb. a Bushel of Oats scarce yielded 18 lb.

10. The abstracted Spirits are prepared as follows : Take Wine, or its Spirit, or good Malt-Spirits, pour them on the Plant whose Spirit you want ; for Example, on Camomile, Lavender, or Rosemary-flowers ; let them stand together and macerate for some time, at least for eight Days ; then draw off the Spirit by the *Vefica* or Alembic, and let it run so long as fatty Veins appear in the Still-head, or so long as it smells and tastes strong ; for
what

what comes over last smells almost stronger of the Plant than the strongest Spirit, which comes over first. If you would impregnate it still more, and render it stronger in Taste and Smell, you may pour it once or more times on fresh Plants or Species, and after due Maceration draw it off again; in this manner, not only the several odoriferous simple Spirits, or spirituous Waters, are made with Wine, as the Spirit of the Lilly of the Valley, Elder-flowers, the Cinamon, and Balm-waters, with Wine, &c. but a vast Number of compound Spirits, the several Aqua Vitæ's, antaplectic, antepilectic, cephalic, stomachic, hysteric, &c. Waters.

11. We must not here omit, that for some resinous Subjects, as Amber, Mastich, Aloeswood, and Balsam of *Peru*, wherein the fragrant Portion is wrapt up and entangled in numerous viscid Particles, Infusion and Digestion with bare ardent Spirit is not sufficient properly to open them, but that it is also necessary to call in Aid some Salt of Tartar, or other pure alkali Salt. *Vid. Hoffmann, Diss. de Balf. Peruv. p. 18, 19. It. Annotat. ejusd. in Poter. p. 440. seq.*

12. From

12. From what we have hitherto said about the Manner of impregnating ardent Spirits, by abstracting them from other Simples with a new Odour, Flavour, and Virtues, we may easily determine the Dispute, whether ardent Spirits be all of the same Nature, or whether the Spirit procured from Wine, its Lees, from Mead, Sugar, Wheat or Rye, may indiscriminately be used one for the other; for tho' we should grant, that by the Addition of another Simple during Fermentation, or after Fermentation, by the bare Abstraction therefrom they would be considerably alter'd in Taste, Smell, and Virtues, yet doubtless in the first Fermentation and Distillation from the Ingredients from which they were produced, they would carry over along with them a peculiar Smell, Flavour, and Virtue, which for the most part they would retain in Rectification. Thus *Borrichius* has remark'd, that the Spirit from Mead or Honey has some Pre-eminence in asthmatic Affections; and *Becher* prefers the Spirit from Sugar to all other Spirits for Pleasantness; and the Spirit prepared from Wheat is far more palatable than that commonly distilled from Rye.

13. The

13. The Effences and Extracts of Vegetables are commonly made with Spirit of Wine, and yet other Menstruums are no wise excluded; and Spirit of Wine is often not sufficient alone to absorb all the Parts to be dissolved or extracted; as we plainly see in Myrrh, which even wholly yields not to a tartarized Spirit of Wine, but above a half is left behind, easily soluble in Water.

14. And when a Plant holds much gummy and gelatinous Parts, in that Case, as was said above on Solution and Extraction, aqueous Menstruums are the best; only there is this one Inconvenience, that such Effences thus prepared keep not so well, but readily foul or musty. In Extracts the Business succeeds better, as there the Menstruum is re-separated by Inspissation.

15. Hence some, when they would use aqueous Liquors in the Preparation of such Effences, impregnate them first with Salts; and on this depends the *Essentia alexipharmica Clauderi*, as also his *Elixir aperitivum*.

16. But we are in particular to observe of Purgatives, that by such saline Menstruums, especially alkaline, they are greatly weaken'd, nay, entirely castrated; on which account others, as Dr. *Vaterus*, was used to take to his

his *Elixir purgans* the Lixivium remaining of the *Arcanum duplicatum*, as a neutral Salt.

17. But where you suppose Spirit of Wine to be either useful or necessary, in Imitation of Dr. *Michaelis*, you may always employ the ardent Spirit of the Plant itself, or at least draw over or rectify common Spirit of Wine therefrom.

18. But such Essences may be prepared from all Vegetables, nay, even from their several Parts; and in particular, such are best adapted thereto as have any remarkable Odour and Taste. In the Animal Kingdom there are very few Subjects employ'd in this View, except Castor, Vipers, and perhaps Mummies; tho' as to the last, the Spices wherewith they are embalmed from the Vegetable Kingdom, deserve more Regard than the little that accrues to them from the Animal Kingdom. If you except the Essences of Ambergrease and Amber, and at most the Tincture made from Glafs of Antimony with distilled Vinegar, we are to expect no great Matters from the Mineral Kingdom; for the tartarized Tincture of Antimony, as also the Essence or Tincture of Iron, and the Tinctures from Gold, are rather saline than sulphureous Productions.

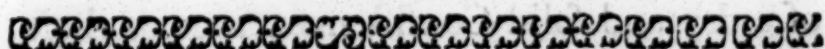
19. The

19. The expressed Oils come also under this Head, and are for the most part made from Vegetables too, and principally from their Seeds and Kernels; the best known and most in use is the Oil of Olives, Almonds, Peach-Kernels, Linseed, Poppies, Rape-seed, &c. Besides the Oil of Eggs, which is expressed from the Yolks boiled or roasted hard, we have none of this Class from the Animal Kingdom.

20. We now proceed to the third Class, which constitutes the sulphureous Productions of a dry and solid Consistence; among these, the first are the resinous Extracts, as the Rosin of Scammony, Jalap, Gum-gutta, which are also by some called Magisteries; and indeed from other Simples, as Guaiac, may such Rosins be extracted with Spirit of Wine; but the above-mention'd purgative Rosins are most in use; and for extracting them, a non-alkalifate, yet highly rectified Spirit of Wine, is the best adapted; and you must at least take six Parts to one of that which is to be extracted, and the Remainder may be also extracted with Water; nay, even the Water with which at last the Rosins are separated or thrown down from the Spirit be evaporated, and you have still a gummy Extract.

21. In

21. In fine, under this Head are to be brought the Flowers of Benjamin and Sulphur, and Cinnabar too; of which last we have said all that was needful in the Chapter on Sublimation. Flowers of Sulphur are made by Sublimation in glass or close earthen Vessels; in subliming the Flowers of Benjamin, they commonly use a Cone of Paper only; yet according to *Hoffmann's* Direction, fine Flowers, or rather Crystals, may be extracted from Benjamin by means of Water.



CHAP. V.

The Earthy Productions.

1. **T**HE earthy Productions are such Matters, as have not only the Form of a Powder, Dust or Earth, or easily assume it, and are without any peculiar Odour or Taste; but which neither dissolve in Water, Spirit of Wine, or other aqueous or oleaginous Menstruum: now some of these are totally fix'd, so as to lose nothing in a naked Fire; others again are only semi-fix'd,
and

and of these a good deal evaporates in a strong Heat.

2. Of the first Species are most mineral and metallic Calces, made either by simple Calcination, or by Detonation with Nitre; as the *Antimonium diaphoreticum*; and which differ not greatly from it, Ceruse of Antimony and mineral Bezoar, the *Terra vitrioli dulcis*, Minium, Litharge, and the several *Croci* of Iron and Sulphur. But it is worth remarking, that they lose their Fixedness, and commence volatile, directly upon re-obtaining, by Reduction, their glossy and ductile metallic Form. Hither are also reducible the Parts of Animals, especially the harder calcined ones, as burnt Hartshorn, calcined Shells, and the specific Febrifuge of *Strobelbergerus*.

3. To the second Species are referable the *Crocus Metallorum*, Glass of Antimony itself, *Mercurius Vitæ*, the *Luna Cornua*, and *Plumbum Cornuum*, and most Magisteries thrown down out of acid Solutions with an Alkali, or another Acid; for they retain much of the saline Particles of the Menstruum employ'd therein; whence afterwards these saline volatile Particles not only evaporate in a strong Fire, but often carry along

K

with

with them a good deal of the dissolved Body ; and the most fix'd Iron of all, when made into a Vitriol of Iron, and afterwards thrown down again with an Alkali, acquires thereby such a degree of Volatility, as in an open Fire almost totally to evaporate. *Vid. Stabl. Observ. Chym. Mens. Septemb. p. 137.*

4. As to the rest, there is no small Dispute about the Use or rather medicinal Effect of these Magisteries. The old Physicians, as *Crollius, Hartman, Michaelis*, have had them in great Esteem, and ascribed peculiar cardiac, antepileptic, &c. Virtues to them. The later Physicians reject them entirely. 1. As being already, out of the Body, charg'd with Acids, they could not afterwards, when taken internally subdue and sweeten the morbid Acid. 2. As they are for the most part totally insoluble, even by the strongest Acids, and consequently cannot mingle with, or be distributed among the Humours of the Body.

5. But here, as in the like Cases, the Mean is most eligible ; for tho' such Magisteries be no longer an Antacid or Absorbent, yet they might acquire other Virtues, as diuretic, strengthening, or gently astringent : and even Absorbents themselves commonly operate better when administered along with Acids ; and therefore

therefore observing Physicians assure, that *Michaelis's Specificum Cephalicum* does better than the Cinnabar alone, without such Magisteries or other earthy Productions: besides, it is no wise essential to a good Medicine, that it should totally dissolve in the Stomach, and enter the Mass of Blood; and scarce is this to be expected of diaphoretic Antimony, Cinnabar, or Crocus of Mars, which notwithstanding sufficiently manifest their Effects. To conclude; *Ludovici* has already remark'd, that tho' such Magisteries no longer re-dissolve in their former acid Menstruums, yet in urinous Menstruums they suffer themselves in some measure to be dissolved. *Vid. Dan. Ludovici Pharmac. p. 35. It. ejusd. Annotat. ad Dissert. I. p. 84. seq.*

F I N I S.

the first of these is the fact that the
the second is the fact that the
the third is the fact that the
the fourth is the fact that the
the fifth is the fact that the
the sixth is the fact that the
the seventh is the fact that the
the eighth is the fact that the
the ninth is the fact that the
the tenth is the fact that the



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